BULLETIN

OF THE

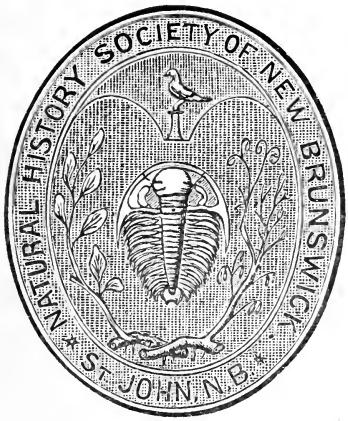
NATURAL HISTORY SOCIETY

OF

NEW BRUNSWICK.

No. XXIV.

VOLUME V. PART IV.



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CONTENTS.

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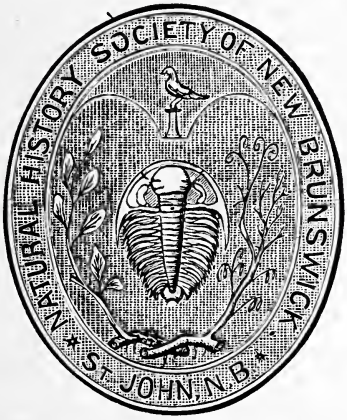

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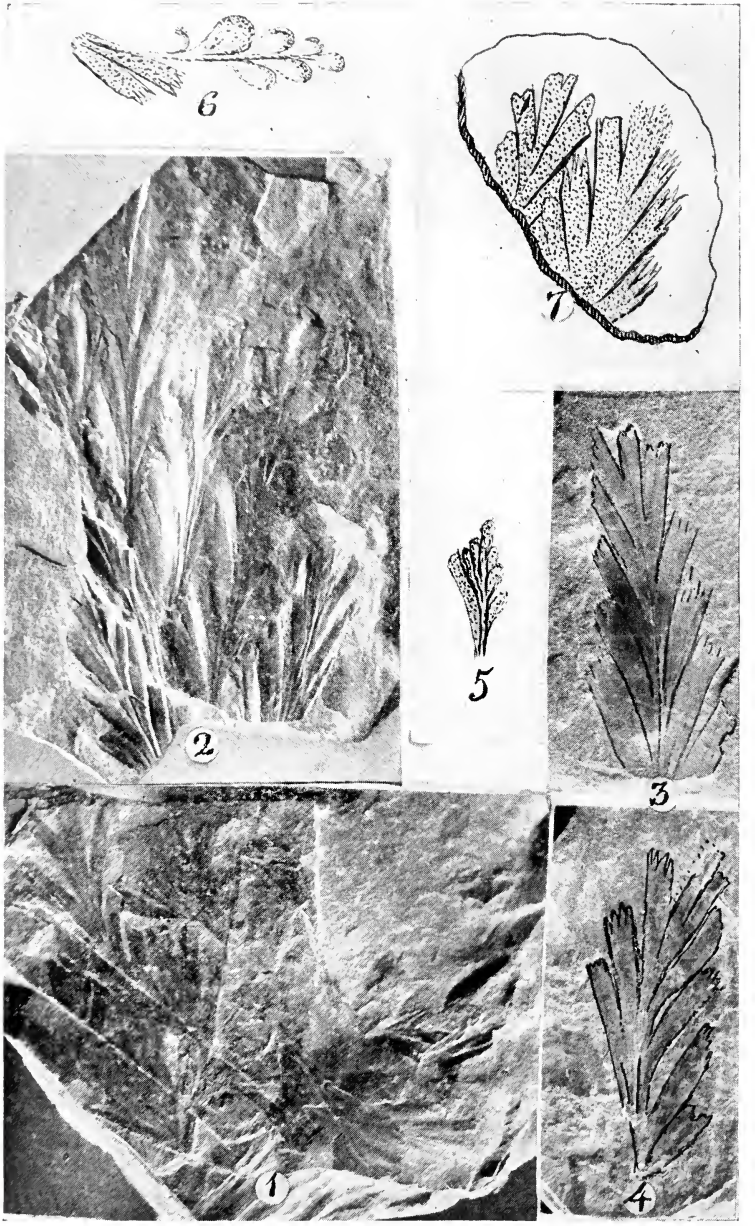


PSEUDOBAIERA McINTOSHII, n. sp. and mut, FLABELLA.

ARTICLE I.

NEW SPECIES AND A NEW GENUS OF DEVONIAN PLANTS.

By G. F. Matthew, LL.D., D.Sc., F.R.S.C.

Read February 4, 1906.

Some members of our Society have, during the past summer, given a good deal of attention to the collecting of minerals and fossils around the city. Two of these gentlemen, Messrs Wm. McIntosh and A. Gordon Leavitt, in their quest have visited the localities for fossil plants, which some forty years ago yielded a rich flora of Devonian age to the labors of former members of our Society, and have been fortunate in discovering some new plants in the Dadoxylon Sandstone. The plants described in this paper were taken by them from beds about 200 feet below the summit of these sandstones, and therefore that distance below the prolific measures of the Lower Cordaite shales which had been worked by myself and the late Professor C. F. Hartt, and at a later date by Mr. W. J. Wilson.

I shall first describe a very interesting form obtained by Mr. McIntosh.

Pseudobaiera, n. gen. Pl. VIII.

This genus is represented by certain thick smooth leaves which in appearance and structure combine the characters of Filicales and Ginkgoales. The leathery leaves having strap like lobes, ending in mucronate points recall Baiera, while the general port of the plant is that of a fern.

The frond is tripinnate and seems related to Eremopteris, and Triphyllopteris. It is regularly alternately pinnate, the pinnules deeply cleft into strap-like lobes, which lobes also are alternately pinnate and decurrent on the mid-rib. Venation obscure, owing to the thickness and smooth surface of the pinnules.

In the fertile pinnules the lobes are replaced by obovate sporangia or seed vessels, alternately pinnate as in the barren frond, and becoming smaller toward the end of the pinnule.

The plant representing this genus has a general resemblance to *Cyclopteris dissecta,* Goepp. (Sphenopteridium)*, as well as to *Eremopteris* of Schimper; but both these forms are bifurcate in the rachis, have more numerous veins and a more flabellate pinnule—It differs from *Sphenopteris* in the broad flat pinnules and absence of a prominent nerve in the lobes. From *Hymenophyllites* by the absence of alation on the rachis and its sub-divisions.

The fruitage may be compared with *Palaeopteris,* expect that the pedicelled group of reproductive bodies of the fertile pinnules of that fern, are replaced by a single sporangia or pod-like body in this genus.

PSEUDOBAIERA MCINTOSHI n. sp. Pl. VIII. figs. 1 to 6.

The species is represented by incomplete fronds.

The rachis is smooth but has longitudinal shallow furrows. Attached to it are pinnæ the rachis of which has a somewhat scabrous, undulate surface, and shows when decorticated a number of vascular bundles.

The pinnules are set on this rachis about half an inch apart on each side and at an angle of about 50° to 70°; they are long-oval in form, are about an inch and a half to two inches long and are about three-quarters of an inch broad, and are slightly arched forward in the outer half. They are deeply incised into about five long narrow lobes on each side and a terminal lobe; the side lobes are directed forward at the ends and are decurrent on the mid-rib; the lobes are alternately pinnate, slightly arched forward, have nearly parallel sides, and are truncate-lacineate at the ends, where there are from three to five mucronate points; in the lateral pinnules the first two lobes on the upper side are frequently united for one-half their length. The pinnules are thick and

* Zittel's Palæontology Vol. III, Plants, p. 108.

smooth and the venation quite obscure, except near the end of the lobes, where from three to five veins can be made out, one vein running to each mucronate point; decorticated examples show several parallel nerves about the middle of the leaf.

The fertile pinnules are of smaller size and bear alternately pinnate, spatulate-oval, (hollow?) pod-like bodies or sporangia; in the examples known these bodies do not extend to the base of the pinnule, but there are one or two barren strap-like lobes. This pinnule is about an inch and a half long and half an inch wide and shows about four spatulate lobes on each side. These spatulate lobes show a branched venation and possibly held seed vessels which became detached.

From the number of detached pinnules of this species found scattered on layers of the shale it seems probable that the plant had a deciduous habit.

Horizon and *Locality.* This plant was collected from a thin bed of shale about 200 feet below the summit of the Dadoxylon sandstone by Mr. Wm. McIntosh, at Duck Cove, Lancaster, N. B.—Not rare.

The resemblance of this plant in its mode of branching etc., to *Baiera* may be seen by comparing its narrow, upright, pinnate lobes to the lobes of the leaves of Baiera; compare also the alternate pod-like fruit.*

The following plants were found to occur with this species—A species of Cordaites is quite abundant. It is probably a variety of *Cordaites Robbii,* Dn, but the Cardiocarpus which occurs with it is smaller and less fleshy than *Cardiocarpus cornutus* of the Lower Cordaite shales. Two abundant plants are an Astero-calamites allied to *A. scorbiculatus,* Schoth. and Calamites *cf.* C. *Cistii.* And C. *cf. Suckovii* also occurs but it is not nearly so plentiful. The remains of these four plants according to Mr. McIntosh comprise three-quarters of the collection made by him from this bed.

Remains of ferns are rarer. There is an Alethopteris differing from *A. discrepans,* Dn, the common species of the Lower Cordaite

* See Zittel's Palæontology Vol. III Plants,, p. 253.

shale. A Neuropteris occurs which is not *N. polymorpha,* Dn., so abundant in the higher measures. An obscure Sphenopteris and two forms of Pinnularia (one is *P. dispalans,* Dn.) occur.

In consequence of the coarseness of the matrix it is difficult to read the intimate characters of these ferns, but it is evident that the flora occurring with Pseudobaiera was somewhat varied.

Mutation FLABELLATA, n. mut Pl. VIII. fig. 7.

In this form the pinnules were somewhat more than half an inch apart on the side of the rachis. The pinnules appear to have been about one and a half inches long and were about three-quarters of an inch wide; they were thinner than in the typical form and the lobes more spreading; also the ends of the lobes were more frequently and more deeply gashed; the veins also are more readily seen.

Horizon and *Locality.*—Found in Plant Bed No. 2 of Hartt's series.—Scarce.

I have had this form in my collection for many years, but thought it too imperfect for description. It is now clearly seen to be related to the plant discovered by Mr. McIntosh.

ANNULARIA Brongn.

Not far above the bed containing Pseudobaiera Mr. Leavitt discovered a fine example of a plant of this genus. It may be referred to Brongniart's.

ANNULARIA LONGIFOLIA.

As a variety or mutation under the name of

mutation LEAVITTI, n. mut, Pl. IX.

Stem about 3 mm. wide. Length between the internodes 30-37 mm.; about 24 leaves in a whorl; length of leaves 30-50 mm.; width 3-6 mm.; there is a strong mid-rib and a slender pointed tip.

ANNULARIA LONGIFOLIA, Brgt. mut. LEAVITTI.

This form may be compared with *Annularia longifolia* Brongt, as figured by Feistmantel.* The leaves are of about the same length but are in some cases twice as wide, the length between the internodes is also considerably greater. It is also similar to *A. longifolia* Brong. as figured by Lesquereaux.

R. Kidston makes *A. longifolia,* Brong. a synonym of *A.* (*Casurainites*) *stellata,* Schlotheim; and in this he is followed by David White; the latter author figures as *A. stellata* a much smaller form than this I have described; and under the synonym, includes *A. longifolia,* Brong.; his *A. stellata* for size agrees with Dawson's *A. latifolia;* now I have collected Dawson's species in large numbers in the Lower Cordaite shale, but never saw one comparable in size with the mutation *Leavitti;* hence, and for the reason that it occurs at a different horizon from Dawson's form, I must regard it as a different species from Dawson's, though only a mutation of the great Annularia of the Coal measures.

Horizon and *Locality.* From a thin seam of shale in the Dadoxylon sandstone, a little above the Pseudobaiera bed. Duck Cove, Lancaster, N. B. Found by Mr. A. G. Leavitt.

At page 516 of Sir William J. Dawson's Acadian Geology Professor C. F. Hartt has given a section of the strata at the "Fern Ledges" on the Bay Shore in which he gives the Dadoxylon Sandstone an assumed thickness of 300 feet. Considering this as the thickness of these sandstones at Duck Cove, the following would be the relative position of the beds containing the fossils above described to the section studied by Professor Hartt.

	Fe
Dadoxylon sandstone below the plants above described about	88
Dadoxylon sandstone including the seams carrying these plants	12
Dadoxylon sandstone above these beds about	200
Lower cordaite shales (part), containing Hartt's plant beds	140
	440

* Zittel's Palæontology Vol. III (Plants), p. 162.

DESCRIPTION OF THE PLATES.

PLATE. VIII.

Fig. 1. *Pseudobaiera McIntoshi*, n sp.—A pinna with three barren pinnules attached, and two detached.

Fig. 2. The same—A frond with a number of barren pinnules, showing the solidity of the leaf.

Fig. 3. The same—A terminal barren pinnule.

Fig. 4. The same—A lateral barren pinnule.

Fig. 5. The same—A young fertile pinnule with several spatulate lobes and one barren lobe.

Fig. 6. The same—A fertile pinnule with the pod-like sporangia, and two barren lobes at the base.

All figures of the natural size—From the Dadoxylon sandstone, Duck Cove, Lancaster, N. B.

Fig. 7. mut. *flabellata*, n, mut.—Portions of two barren pinnules—Natural size—From the Lower Cordaite Shales. Fern Ledges, Lancaster, N. B.

PLATE IX.

Annularia longifolia, Brngt. mut. *Leavitti*, n. mut.—Stem with four whorls of leaves. Natural size—From the Dadoxylon Sandstone, Duck Cove, Lancaster, N. B.

ARTICLE II.

REMARKS ON THE HYDROGRAPHY OF NEW BRUNSWICK.

By Joseph Whitman Bailey,

Read June 6, 1905.

In view of the careful hydrographic surveys of New England made in recent years by the United States Geological Survey, it is noteworthy that New Brunswick, which affords a most interesting field in this respect, has received scant attention. The questions involved have at least as much economic as scientific value.

A noticeable general feature is that quick-flowing rivers of the southerly portion of the Province become so low in the late summer that navigation, even by canoe, is difficult or impossible, while nearly all rivers of the northern part, indeed many mere brooks, contain a quite copious flow of water. A general division line between the two classes may be taken as following the valley of the Southwest Miramichi up to the forks, and thence striking across country to Andover. While the Nerepis, for instance, may be nearly if not quite dry above the "deadwater" near its mouth, the Indian freely poles his loaded canoe up the Quisibis or Gounamitz, streams of no greater hydrographic area. The basin of the Magaguadavic at St. George equals, perhaps exceeds, that of the Nepisiquit at its Grand Falls, but how inferior is the low-water volume of discharge! Upper Garden's Creek, in Prince William, equalling in length some small northern rivers, occasionally becomes quite dry at its mouth, while the Mactaquac and Pokiok make little better showing. Some small southerly brooks at times contain running water in their upper parts, while quite dry below. The writer remembers catching a good string of

trout in the upper reaches of Mill Creek, below Fredericton, although the flow between pools was very small, at a time when the stream bed, near its mouth, was as dry as the railway track which crossed it.

The conditions for copious summer flow apparently do not extend westward from Andover across Maine, as the Aroostook, the main St. John above Allagash, and the Chaudiere River in the Eastern Townships, become astonishingly low at times. Indeed the steady supply of water for power at Grand Falls depends largely on four tributaries of the St. John, the Madawaska, Fish, St. Francis and Allagash Rivers, all of which have large lake expansions in their lower or middle courses, ideally situated to serve as reservoirs. Eastward, in the Gaspe peninsula, those rivers I have seen appear to have a summer discharge disproportionately large for their limited catchment basins.

Many factors contribute to the general features above noted.

1.—The extent of forest. The forests retard evaporation by their shade, and control, by their sponge-like mosses and undergrowth, a too rapid flow of surface water. Forest denudation, principally by fire, has probably been the primary cause of the marked decrease in the summer flow of the St. John, a decrease sufficient to greatly shorten, in the last forty years, the period of steam navigation above Fredericton. A dense growth of spruce, fir and cedar, very common in New Brunswick, is a better protection against drought than a growth of deciduous trees.

2.—Lakes, swamps and "deadwaters". These store up, as reservoirs, the flow of many brooks, producing the more decided effect as they are the more remote from the source of the stream. Madawaska and Fish Rivers are the best local examples. Even the little beaver-dam may be noted in this connection, and the obstruction of fallen trees. The latter often form the nuclei of extensive drift dams, such as "The Big Jam" of the Horton Branch of the Tuladie, which became so long and tangled that the stream-drivers cut a new channel for the river, in preference to undertaking its removal.

3.—The condition and character of the soil as affecting the percolation of water. Obviously a soil allowing free percolation

to a stream after rain may have the counter effect of absorbing the stream in dry times. While normally, in the case of ancient river valleys, the banks become of finer texture as we descend the stream, due to deposition of the coarser flood-borne material in the more rapid upper reaches and of the lighter silt below, yet small tributaries, when nearing the main stream, are often obliged to assume the torrential character, washing the finer material from their beds, and leaving collections of gravel, loose stones, or even bowlders, into which the attenuated summer flow from above may sink and disappear. Long's Creek, in Kingsclear, presents this appearance, and such conditions may have caused the above noted phenomenon on Mill Creek.

4.—The general geological structure of the region, as bearing on subterranean flowage. It is quite possible that rain water falling on the basin of one river may occasionally sink to a level which carries it under the channel of that river, and into some lower valley, there to appear as springs. Possibly Nepisiquit Lake supplies water to the Little Tobique in this manner.

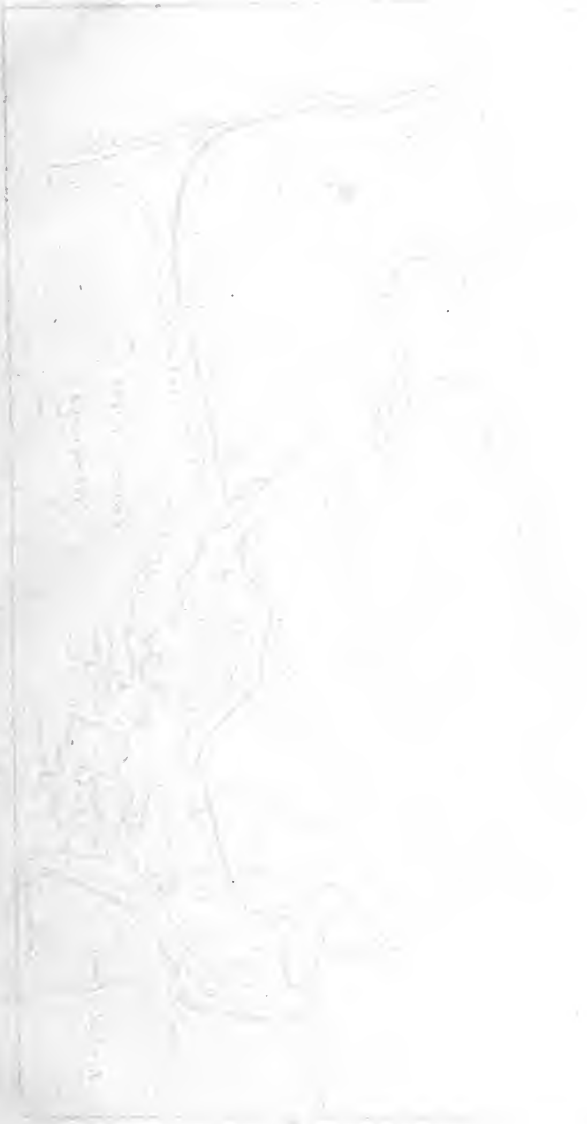
5.—The extent to which a stream is fed by springs as distinct from surface drainage. Conditions in this respect are connected with the two next preceding causes. It seems safe to say that springs are the more numerous in the northern highlands. Spring Lake, the head of the Little Tobique, is the most striking illustration. Its outlet is a wide stream of running water, capable of floating loaded canoes. The navigator virtually sees the source of his river, so far as it is an open visible stream of any size, but a few yards before him. I believe Dr. W. F. Ganong ascertained the temperature of Spring Lake to be only 40° Fah. in August.

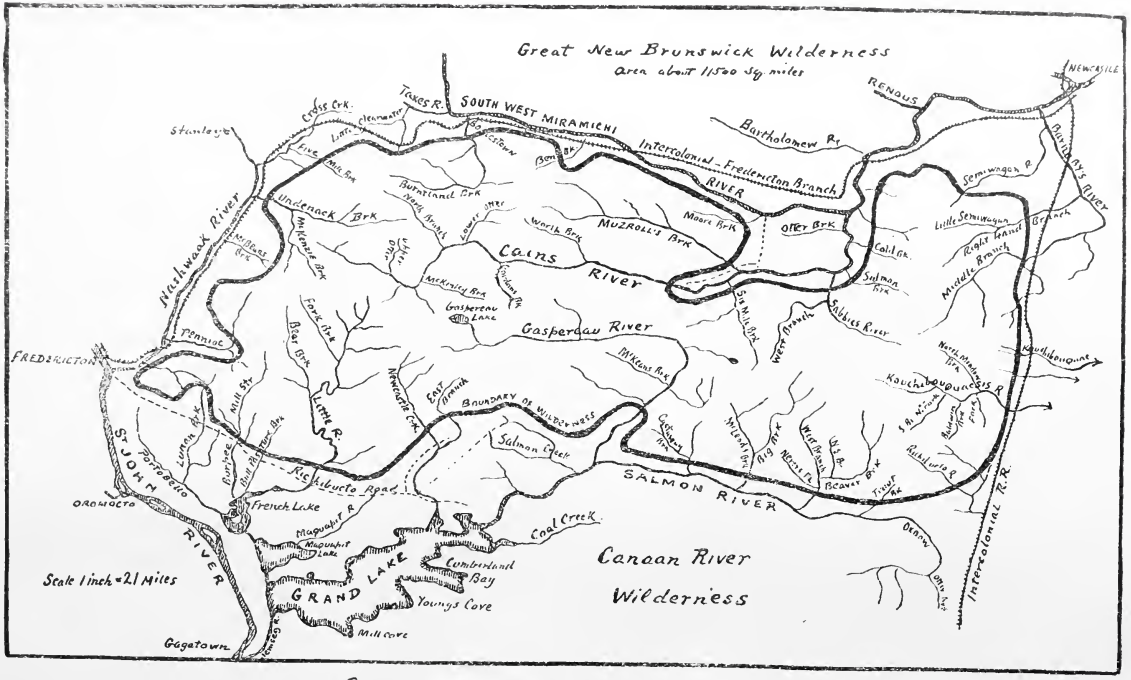
6.—The slope of the river valley. In some cases, notably those of the Nepisiquit, Little Southwest Miramichi, and Right Hand Branch of the Tobique, lakes and deadwaters near the source offset the unfavorable effect of rapid descent in the lower river. The Northwest Miramichi, although in the region of copious flow, has periods of extreme low water, doubtless owing to its rapid descent and the complete denudation of forest near its main source.

7.—The width of the river channel, as affording exposure for evaporation. Log driving, both in itself and as opening the way for increased erosion by flood water and ice, has materially altered some of our river channels. The writer recalls a large "undriven" brook entering the Serpentine which had not one-fourth the width of neighboring "driven" brooks of apparently equal volume.

8.—The extent and distribution of rain-fall. This is the most important factor of all, and statistics are not obtainable for all parts of the Province. It seems probable that the mean annual rain fall is much the same throughout, and that the streams of the northern highlands are less subjected to droughts than the others, and receive the benefit, in hot weather, of more frequent showers and electric storms. In August, 1904, after a steady twelve-hour rain, a rise took place on Taxes River, altogether out of proportion to that of the Miramichi and neighboring brooks. Our party, taking advantage thereof to pole up seven miles against a murky torrent, was left the following day with merely enough water to carry the canoes back over the sand bars. The gently-sloping well-forested Taxes valley would not point to such conditions. Perhaps some "cloud-burst" occurred over the upper waters.

The various causes above given as affecting the discharge of our rivers may so co-operate or offset each other in a given case that each stream requires separate consideration. In connection with the first important factor, that of forest and swamp, we append two maps, one of the great New Brunswick wilderness, extending into Quebec, which exceeds in area the Maine-Quebec, wilderness by nearly 1000 square miles; and one of the Cain's River wilderness, so called after its principal stream, the second largest area of New Brunswick wild land. The third of such areas in size is that about the head of Canaan River. Large wild tracts also exist in Charlotte County and in Gloucester County, east of the Intercolonial. Smaller tracts are found in all directions. The regions here referred to contain, up to the present year, no railways, no roads, other than those used by lumbermen and hunters, and no permanent human habitations.





Cains River Wilderness

This condition of things, at least as regards railways, will shortly disappear.

The great New Brunswick or northern wilderness, soon to be divided by the railway from Campbellton, contains about 11,500 square miles. The mean elevation is probably about 850 feet, with a maximum elevation of about 2,700 feet at Mount Carleton near Nictor Lake. It has suffered quite severely from fires, especially in the region about the middle Nepisiquit and upper Northwest Miramichi. Some thirty-two of its rivers are more or less navigable by canoe. There are fourteen salmon streams, salmon also ascending a few large brooks.

The Cain's River wilderness, area about 1,500 square miles, is remarkable as extending to within two miles of Fredericton. Its mean elevation will not exceed 250 feet.

The purity of our rivers is affected by inequalities of flow, for where variations are extreme the high floods will cause much erosion and the feeble summer stream will be ineffective in carrying off accidental impurities. The normal impurities of New Brunswick streams may be considered under three heads:—

First—Unseen impurities, only determinable by such chemical analysis as has recently been made of the St. John at Fredericton.

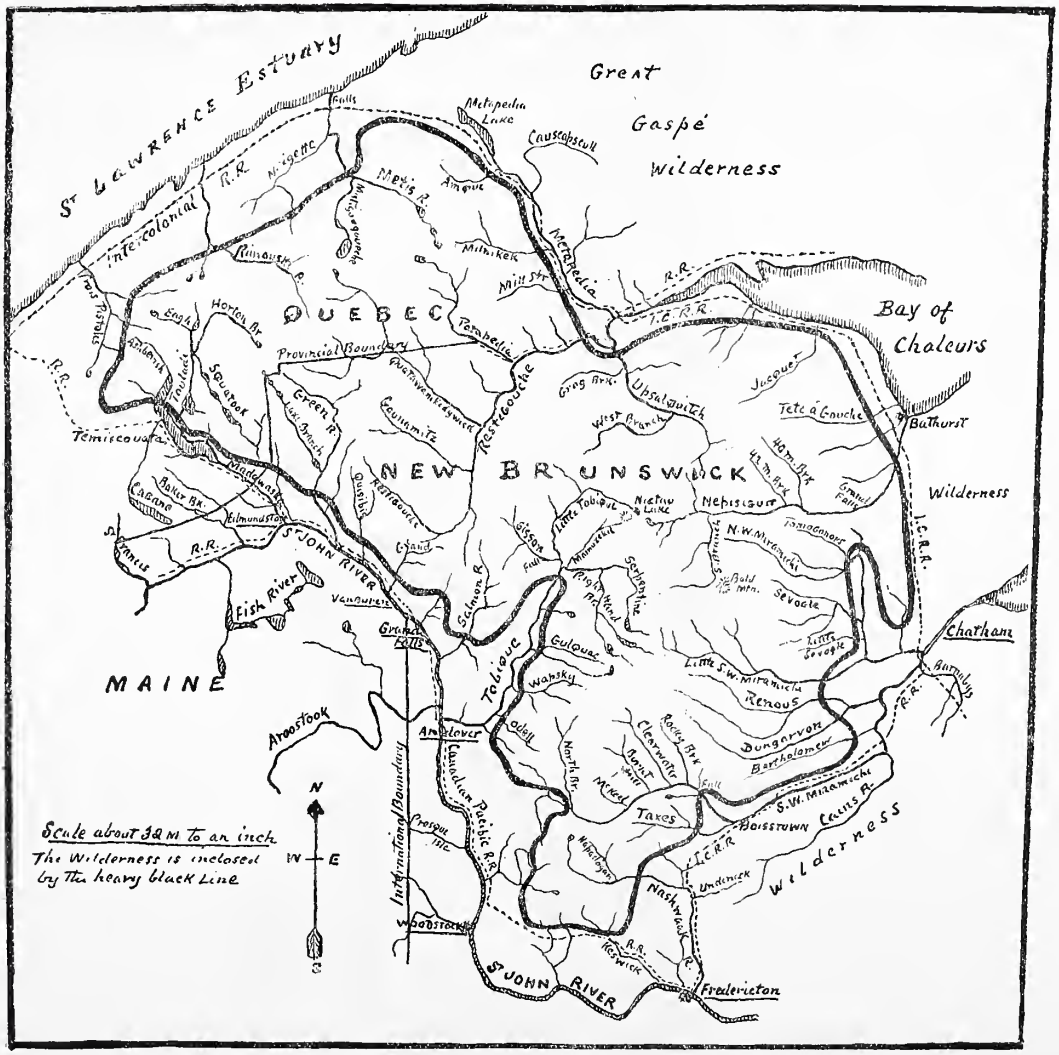
Second—Such impurities as produce color-effects in the water. This subject has been considered by Dr. Ganong. See Bulletin No. XVI. of the Natural History Society. Here also chemical analysis is necessary to a full understanding. I may add that like contrasts between green and brown rivers draining almost parallel valleys are found to perfection in Gaspe Peninsula, and throughout the Quebec wilderness, and extending at least as far west as Lake Superior. While the great lakes on the St. Lawrence and Richelieu rivers not only act as settling basins, but discharge greenish streams of wholly different appearance from the great majority of their feeders, we observe no such effect with our Fish, Allagash, St. Francis and Madawaska Rivers. We cannot even class these streams among our "clear-waters," and Fish River, which has the greatest lake extent, is probably the darkest of the four.

Some of our wine-colored streams seem to get clearer as they descend. The Nepisiquit is clearer at its beautiful Grand Falls than at the Bogan Pool above, and the rather dark waters of the Wapsky, Odell and Three Brooks have less effect than might be expected on the transparent stream of the lower Tobique. Most of our streams undergo marked color changes, dependant, I think, to a great extent, on the height of the water. Thus the usually green Restigouche, fairest of all our rivers, has been observed by Dr. Ganong to acquire at times the more prevalent brown or amber tint. It seems natural to expect the strongest color in a stream at medium height, when the water is in contact with much vegetable matter in the swamps and low places, and when the volume is not so very great as to diffuse the natural pigments.

Third—Ordinary sediment. Obviously such of our streams as have thickly settled valleys are the most highly charged with sediment during floods. It usually produces the color of yellow ochre, and never, I believe, in New Brunswick, that milky white appearance observable in certain streams of the Laurentides. Other forms of sedimentation are mentioned in Dr. Ganong's article. New Brunswick has no waters so heavily silt-laden in summer as those of the Missouri, or even of the lower Ottawa.

On rivers without great lake expansions the principal deposition of silt is usually at their mouth, or marine deltas. Dr. Matthew observes, in a former bulletin of the Society, that the real delta of the St. John is some fifty miles inland. We think no other river in the world has this feature so plainly marked; although, in a less degree, the phenomenon is very common. We may mention the Hudson below Troy and the St. Lawrence at Lake St. Peter, although, in the case of the St. Lawrence, the deposition is really at the delta of the Ottawa, the main stream, above Montreal, being far more free from sediment than any other of the World's great rivers. Inland sediment deposits of this kind seem frequently caused by the submergence and obliteration of ancient deltas by continental subsidences.

A table is added of the approximate drainage areas of all the principal New Brunswick streams, and of their larger tributaries, from which their relative mean annual discharges, but not their



THE GREAT NEW BRUNSWICK WILDERNESS

relative low water discharges, may be reasonably inferred. Lack of accurate topographical surveys of the watersheds makes the results given merely fair approximations, and where, by different calculations, some areas have been found to be about alike, I have recorded them as quite the same, rather than to chance misplacing a river in the series.

It is interesting to note that our Grand Falls discharges the collected waters of about 9100 square miles, an area somewhat larger than Massachusetts, while the St. Maurice at Shawanegan Falls, the site of such recent and extensive economic development, drains about 12,400 square miles, the Ottawa at Chaudiere Falls about 40,000 square miles, Niagara 241,000 square miles. The entire catchment basin of the St. John has been hitherto given at 26,000 square miles, an estimate that several calculations show me to be grossly incorrect. Much the largest hydrographic unit solely in New Brunswick is the system of the Miramichi.

INDEX OF APPROXIMATE HYDROGRAPHIC BASINS OF PRINCIPAL NEW BRUNSWICK RIVERS AND LARGER TRIBUTARIES.

RIVER	SQ.M.
Magaguadavic	680
Miramichi	4620
above N. W. Branch	3975
above Boiestown	1090
N. W. Branch	1590
above Little S. W.	850
Renous	575
Cain's	575
Nepisiguit	800
at Grand Falls	600
Restigouche	4740
above Kedgwick	640
Metapedia	1430
Upsalquitch	910
Kedgwick	620
Patapedia	300
Petitcodiac (at Moncton)	600
St. Croix	1630
St. John	21300
above Allagash	2950
at Grand Falls	9100
at Andover	13200
at Fredericton	16000

All these waters are tributary to the St. John River.

RIVER.	SQ.M.
Aroostook	2160
Mesardis	260
Big Machias	225
Tobique	1560
Right Hand Branch	410
Little Tobique	370
Jemseg	1470
Maquapit River	330
Allagash	1450
Madawaska	1140
Fish River	950
Kennebecasis	850
Oromocto	810
Washademoak	775
St. Francis	700
Big Black	600
Nashwaak	575
N. W. Branch	550
Green River	475
Meduxnekeag	420
Eel River	230
Meruimpticook	200
Miramichi, Little S.W. Branch	575

ARTICLE III.

NOTES ON CAMBRIAN FAUNAS.

By G. F. Matthew, LL.D., F.R.S.C.

Read 6. March 1906.

In the Transactions of the Royal Society of Canada will be found a series of short articles on the Cambrian faunas, two of which appeared in the second series, Vol. VIII, Sec. IV, page 93, of that publication. The following is a continuation of that series:

No. 9.—Ostracoda.

Bradorna (?) robusta.—For want of distinctive generic characters this species when described was referred provisionally to Prof. T. Rupert Jones genus Aparchites. At page 461 of the article on the Cambrian Ostracoda of Cape Breton (see Can. Rec. Sci., Vol. VIII, No. 7) we have suggested a possible relation to the species falling under the genus Indiana. The following remarks in this connection may be added.

B. (?) *robusta* in its large size is parallelled by only two of the known forms of the Etcheminian Ostracoda, viz. *Leperditia* ?? *rugosa* and *Bradorna perspicator*, mut. *maxima*. It has much of the general outline of the former, but is not so wide in front and has a shorter hinge line; it possesses a similar marked border fold behind. But it is a more ventricose shell and is not wrinkled along the lower side of the shell. This species has a row of somewhat distant tubercles around the ventral curve of the valve a little way off from the margin; this ornamentation was not seen on a specimen from Hanford Brook.

Compared with the second form noted above (mut. *maxima*) it appears more rounded at the posterior marginal slope, and has a less decided hinge line, this line being shorter and somewhat

Continued on Page 475.

ARTICLE IV.

NOTES ON A GRINDSTONE QUARRY AT STONEHAVEN, GLOUCESTER CO., N. B.

By Geoffrey Stead, B. A. C. E.

Read April 4, 1905.

At Stonehaven, about 18 miles east of Bathurst on the south coast of the Bay Chaleur, is a fine quarry where grindstones, scythe stones etc., are manufactured in large quantities. The larger grindstones at least are exported to the States where a single firm uses about 400 per year from this quarry, I believe in the making of large knives, machettas, etc.

The quarry lies below the level of high water and a dam is therefore built around the workings to exclude the sea. All gravel and waste material is then removed from the surface and a bed of good quality stone is left exposed. A channel two or three inches wide is cut through the centre of the top layer of stone and by means then of parallel and perpendicular channels, blocks of the required size are detached.

The first channel must be cut completely through the bed, the parallel and perpendicular channels may be only two or three inches deep when by means of wedges the blocks of stone are split out.

Making the first deep channel is a tedious process as it is done by hand with picks, and on seeing this, I remarked that a chisel or channeller driven by steam would perform the work much more quickly and cheaply. The quarrymen, however, explained that the steam channeller could not be used as it would bind in the cut, for as the channel is made the sides of the rock creep together, the total amount of this movement being about an inch and a half. At times when the channels are being made, the unequal strain coming on parts of the bed not yet cut through, causes large spawls or chips to crack out, thus spoiling many blocks of stone suitable for grindstones.

I thought it interesting that, though in a small way, yet very clearly, a pressure and movement in the earth's crust was here shown to be still in operation, which has during past ages resulted in the crumpling and bending of the earth's crust to form on the one hand mountain ranges with parallel ridges and valleys, and on the other hand elevated plateaus and areas of depression.

About St. John we see evidence of the extreme movement in the upturned and folded strata on which the city rests. That movement has occurred here in comparatively recent times was shown by Dr. G. F. Matthew in describing some faults or displacements in the rocks of the Hospital Hill which must have occurred since the Glacial Period.

The shrinkage, through cooling, of the Earth's mass and consequent settlement of the crust of the Earth, is the primary cause of these movements and it produces great lateral pressure in the rock strata which is noticeable in the movement of the rock in the Stonehaven quarry when the pressure is relieved by cutting through the strata.

In Ohio a level formation is found similar to that in the New Brunswick coal measures and whereas the amount of stone of quality suitable for grindstones is large, it is exceptional to find areas where the beds contain blocks of sufficient size to be used for that purpose.

Where the strata are level and near the surface, the quarrymen claim that they can tell where to look for stone as the ground is generally low and swampy where the most numerous fractures have occurred, and higher and firmer where the best beds may be expected.

At Stonehaven the valuable bed lies with its length parallel to the shore and in an easterly and westerly direction.

The northern side of the bed forms the bottom of, and thins out under, the Bay Chaleur, and thus the pressure here is relieved and, as might be expected, the chief movement is seen when cuts are made across the length of the bed, or in a direction perpendicular to the shore. In other words the pressure upon the sandstones at Stonehaven is only observable as coming from the E. N. E., that is from the direction of the mouth of the Bay Chaleur.

ARTICLE V.

NOTES ON THE NATURAL HISTORY AND PHYSIOGRAPHY OF NEW BRUNSWICK.

By W. F. Ganong.

89.—On a Remarkable Noise Heard During a Forest Fire at Neguac.

Read January 3, 1905.

While in Tracadie in September last I was told of a remarkable explosion which occurred back of Neguac two years ago in July during a forest fire, and which was supposed to be due to the ignition of gas held in a peat-bog. The information seemed so well substantiated and the phenomenon itself of so unusual a character that I sought further information about it from a prominent and observant resident in the vicinity, one to whom I am indebted for much other valuable information, M. Romain Savoy, of Riviere du Cache. He writes me that the event is well known locally, apparently creating much comment at the time, and that he attempted to investigate the cause, even having the ground examined where it occurred. It was not truly an explosion, but a great roar, lasting about five minutes, and was heard but once. It occurred when a forest fire, driven by a warm southerly wind, was burning with great force in a dense forest. In the meantime a heavy cold easterly wind sprang up, the course of which could be followed by its accompanying clouds. It was when this wind, with its cloud, met the southerly wind and smoke cloud, that the noise was heard; and M. Savoy's explanation, locally accepted, is that it was the meeting of the cold and hot air which in some way produced an effect resulting in the remarkable noise.

90.—On the Limits of the Great Fire of Miramichi of 1825.

Read February 7, 1905; later re-written.

Some observations upon the extensive burnt country at the head of the northwest and other branches of the Miramichi, and a desire to determine the rate of reforestation of burnt forest lands in New Brunswick, have led me to attempt to ascertain the precise limits of the great Miramichi fire which occurred in 1825. Two sources of information were obviously available,—first, contemporary records in newspapers, books, maps, etc., and second, the testimony of the age of the timber in the Miramichi valley as known to well-informed lumbermen. The results of both lines of inquiry were the following.

The earliest account of this immense and calamitous fire, (which occurred upon October 7th), that I have been able to find, is dated Miramichi, October 11th, four days after the event. It is a brief but vivid description of the fire, calling attention to the need for aid to the sufferers in whose interest it was printed on the front page of a letter-sheet, evidently intended to be widely circulated with business and other correspondence.* The account of the limits of the fire reads thus:

> At Douglastown, scarcely any kind of property escaped the ravages of the fire.....The Town of Newcastle, with all the surrounding settlements, became a total waste, excepting about fourteen buildings....and four miles through the interior....the greatest desolation took place. The remote settlements from the entrance of the river upwards, present to the eye the dreadful havoc of this most calamitous event, particularly those of the North-West Branch, Baltibog and Nappan, some of which have scarcely a place of habitation left.

Another contemporary account is contained in a pamphlet published in the same year (1825) at Halifax, reprinted, in part at least, in Murdoch's *Nova Scotia* (Vol. III, page 539). It is entirely independent of the Rankin account above quoted, and, so far as the extent of the fire is described, reads thus:

> It has since been ascertained that the conflagration extended from the Northward from the neighborhood of Bay Chaleur, where two cottages

* A letter in possession of Mr. Clarence Ward, to whom I am indebted for the use of his copy of the very rare original (recently reprinted in St. John and Miramichi newspapers), shows that it was written by Mr. Alexander Rankin, apparently an eye witness of the fire.

in the forest were consumed, to Richibucto, a distance of 85 miles by land, —and from that place over the whole extent of the Miramichi and its North and South-West Branches, the Baltibogue, Nappan and Black Rivers, and other tributaries, including a tract of more than 100 miles in a direct line, and containing about 8000 square miles of forest in New Brunswick, subject to the ravages of flame and hurricane. In connection with this may be viewed the burning of a great part of the town of Fredericton, the seat of the Government of that province, on the same day that Newcastle suffered, and the fires in the forests of Upper and Lower Canada, and the State of Maine, where the River Penobscot was described as resembling a sea of fire for thirty miles of its course, and the reader may judge of the extent of the injury to the wood, and the ungovernable rapidity with which the flames must have been carried by the winds, to find them at the same period desolating parts of America from Brockville to Miramichi, and from the Saint Lawrence to the Penobscot. In this extensive range of mischief, the sufferings of the parish of Newcastle were far surpassing all the rest in proportion and miserable consequences.

Mr. Clarence Ward has had the great kindness to go systematically through the fyle of the *New Brunswick Courier* for me, from the date of the fire to the end of the year, and later; but while he found full accounts of the fire in other respects, he discovered no definite references to its limits.

The best-known description of the fire, and one practically contemporary, is that by Robert Cooney, published in his *Compendious History* of 1832. He was living at the time, as he tells us, within a mile of Newcastle, and was an eye-witness of all that he so vividly describes. His references to the limits of the fire are as follows:

In Miramichi, and throughout the northern part of New Brunswick, the season had been remarkably dry; scarcely any rain had fallen; and considerable apprehensions were entertained for the crops. Very extensive fires were observed in a north westerly direction; along the south side of the Baie des Chaleurs; in several parts of the District of Gaspe; in the neighborhood of Richibucto, and thence in a southerly direction towards Westmoreland (page 65).....

On the sixth, the fire was evidently approximating to us; at different intervals of this day, fitful blazes and flashes were observed to issue from the different parts of the woods, particularly up the north west, at the rear of Newcastle, in the vicinity of Douglastown and Moorfields; and along the banks of the Bartibog (page 66)....suddenly a lengthened and sullen roar came booming through the forest, and driving a thousand massive

and devouring flames before it. Then Newcastle, and Douglastown, and the whole northern side of the river, extending from Bartibog to the Nashwaak, a distance of more than 100 miles in length, became eveloped in an immense sheet of flame, that spread over nearly 6000 square miles, (page 69) ....the whole cultivated Parish of Ludlow [at the time of the fire including all Blissfield and Blackville] was changed into a waste.... Bartibog, Nappan, Black-River, and several other surrounding settlements became involved in the general ruin. More than four hundred square miles of a once settled country, now exhibited one vast and cheerless panorama of desolation and despair. (page 76).

And once again (on page 70) he implies that the fire covered some 6,000 square miles.

Yet another, and apparently independent account of the fire is contained in M'Gregor's *British America,* published in the same years as Cooney's book (1832). The author had travelled extensively in New Brunswick, though prior to the fire, and he appears to have had some sources of information other than those above cited, though a part of his description shows the wording of the letter of October 11th. As to the fire limits he writes:

In October, 1825, about a hundred and forty miles in extent, and a vast breadth of country on the north, and from sixty to seventy miles on the south side of Miramichi River, became a scene of perhaps the most dreadful conflagration that occurs in the history of the world (Vol. II, 264).

The following account was obtained and printed in the papers for public information a few days afterwards: "More than a hundred miles of the shores of the Miramichi are laid waste, independent of the northwest branch, the Baltibog and the Nappan settlements." . . . (page 266).

Great fires raged about the same time in the forests of the River St. John, which destroyed much property and timber, with the governor's residence, and about eighty private houses at Fredericton. Fires raged also at the same time in the northern parts of the province, as far as the Bay de Chaleur. (Page 268).

Another independent account, giving the recollections of an eye-witness some twenty-four years after the event, is contained in Johnston's *Notes on North Amrica* (published at London, in 1851). The author, while at Chatham in 1849, was told of the fire by a Mr. Rankin, whose recollections of it were very vivid. Traditions and recollections after a quarter-century has elapsed

must always be accepted with caution, but they are not without their value. The account reads thus:

> It was an excessively hot summer, and fires were burning in numerous places upon the Miramichi and St. John rivers and their tributaries.... on the 7th of October, it began to blow from the southwest, and the fire to spread over the country in the same direction. The wind increased gradually to a hurricane, and the fire advanced with proportionate rapidity. At one o'clock in the afternoon it was still seventy miles up the river; and in the evening it was at Douglastown. It travelled eighty-five miles in nine hours, so that scarcely on a fleet horse could a man have escaped from it.... the most striking thing that he mentioned were, that the flame as it advanced, was twenty-five miles in breadth; that, coming from the west, it rushed past the towns of Newcastle and Douglastown, leaving a green margin of some miles in breadth between its southern edge and the river; and that when, in its easterly course, it reached Burnt-church River, the wind lulled, turned around and drove the fire up the river again. It then came back along the green fringe it had left as it descended, and by the way licked up the towns of Douglastown and Newcastle..... The town of Chatham on the opposite side of the river, in a great measure escaped, but the Nassua [misprint for Nappan] settlement, six miles behind was burned to the ground. (Page 35).

Still another account, resting apparently upon recollections of Sir Howard Douglas, who visited Miramichi a few days after the great fire, is contained in Fullom's *Life of Sir Howard Douglas* (London, 1863). This work gives also a full account of the fires at and near Fredericton, and estimates the extent of the conflagration as 6,000 square miles.

So much for the accounts proceeding from eye-witnesses or others in a position to know the limits of the fire. Later accounts, if compiled with a genuine regard for the truth, have also their value. Thus the valuable book, *Notitia of New Brunswick*, published in St. John in 1838 (page 126), makes the fire cover an extent of one hundred miles along the Miramichi, by eighty-five in breadth, covering a surface of nearly 8,000 square miles. This work tells also of the fire at Fredericton, and of others on the Oromocto and on the Tobique. Gesner, the geologist, who had travelled over much of this country, makes the extent of the fire from the Nashwaak to the Bartibog, a distance of more than one hundred miles, and even makes it continuous with a fire on

the Tobique, which is probably incorrect (*New Brunswick*, 192).

Again Alexander Monro, the surveyor, in his *New Brunswick*, 1855, gives an account of the Province largely independent of other works, and describes the limits of the fire, which he says embraced;—

> Almost the entire country, from within a short distance of the Gulf shore, and the head of the Tabusintac river, thence nearly to the Falls of the Nipissiquit, and from that vicinity in the direction of the Tobique River, and near to its head, and in another direction, beginning at the mouth of the Miramichi River, embracing both its banks, and extending, in some places, beyond the present limits of the county to the Nashwaak river, in the county of York, thus comprehending in the whole, nearly 4,000,000 acres of the best lumbering region of the Province. (Page 202)

Evidence from tradition still current is of course of no great value after so long an interval, (now eighty years) since the fire, but still it is not without use. A valued correspondent of mine, Mr. P. H. Welch of Fulton Brook, Queens County, who has long known the woods of south central New Brunswick as lumber-scaler and through other occupations, writes me that he always understood the fire covered about 5,000 square miles. He also adds:—

> About forty years ago I worked with a man, an ox teamster, who was an eye-witness of the burning [of Miramichi], and worked all over the Miramichi afterwards, and he positively stated that it [the fire] commenced a short distance east of Nashwaksis and burned everything but swamps to the Gulf of St. Lawrence, or, to be more correct, to Tracadie Beach.

Mr. Welch also calls my attention to the words of the Ballad of the Miramichi Fire, composed at the time, and still sung by the lumbermen, one line of which runs "46 miles by 100 this awful fire did extend".

So much for evidence as to the general limits of the fire. We consider next what evidence may be found as to its actual occurrence in particular places aside from Newcastle Parish. Its occurrence back of Chatham, though Chatham itself esceped, has already been noted. Mr. Welch confirms this from the relation of his friend the ox teamster, who told him that a spur "crossed

the main river below Chatham and laid everything waste on the south side of the river to Bay du Vin". He also was told by him that "one wing of the fire crossed the southwest river and ran towards Gaspereau burning itself out south of Blackville". Mr. Welch adds that there is other evidence of its extension in that direction, and he has given me the limits shown on the accompanying map. Mr. Welch's statements on this point receive very satisfactory confirmation from another source. In 1844 Sir James Alexander made a survey for a military road from Moncton to Boiestown, and described his observations in his book *L' Acadie* published in London in 1849. In reference to a badly burned district he had to cross between Gaspereau and Cains River, he writes:—

> We had reached the scene of the Great Miramichi Fire of 1825, when the country was ravaged and laid waste from the neighborhood of Bay Chaleur to Fredericton (II, 1849).

And the matter receives confirmation from yet another source, for Deputy Surveyor Fairweather's plan of this country, made in 1836, (for the opportunity to see which I am indebted to Mr. E. Hutchison of Douglastown), shows that all this country between the Miramichi and the Gaspereau had been heavily burnt, though of course the evidence is not conclusive that this fire was contemporaneous with the Great Fire. Alexander's statement, resting as it no doubt did upon the testimony of some of the men in his employ, would seem, however, to make this clear. The extension of the fire in another direction is shown on one of the plans in the Crown Land Office which marks "Outline of Great Fire, 1825", between Mullins Stream and South Branch Sevogle. Through Mr. Hutchison I learn from Mr. Loggie of the Crown Land Office that there is no other evidence in that office bearing upon the present question.

So much for the evidence documentary and traditional. We consider next the evidence from other sources. Seeking such, it occurred to me that an observant and well-informed lumberman thoroughly acquainted with the Miramichi country, would probably know, in part from the ages of the trees growing there,

the approximate limits of the great fire. Accordingly I wrote Mr. E. Hutchison, of Douglastown, well-known as one of the leading lumbermen of the Miramichi, and placed my problem before him. He has had the kindness to reply fully. He gives it as his opinion that the extent of the fire has commonly been exaggerated; that Derby, for instance, was partially, if at all, burned, and that the limits of the fire were about from Portage River south to the main Miramichi, and from the Square Forks of Sevogle east to Bartibog, with a tongue to near Grande Dune.

His evidence is derived from the relative ages of the timber trees cut within and without those limits. When I called his attention to the positive statements of Cooney, seeming to show a much greater extent for the fire, he replied that he was aware of this discrepancy, but that his judgement was based upon the unassailable testimony of the age of trees standing on the areas in question, and that, while the matter is somewhat complicated by the occurrence of local fires, it is possible to trace the limits of the Great Fire with some accuracy in this way.

He called attention to the well-known fact that Chatham was not burnt, and adds that the occurence of abundant and large old logs all along the south side of the Miramichi, including Cains River, Barnaby River, Black River, and Napan, show that there could have been no extensive fires at that time south of the Miramichi, and that if the great fire did cross the river at all, it must have been only locally and without doing any material damage to the woods.

Further, since much of Derby, together with the basin of the Renous, Dungarvon, and Bartholomews Rivers have all produced immense quantities of logs much older than could have grown since the great fire, there could have been no extensive burning in that region as Cooney implies. The same is true of the district east of the Bartibog.

With reference to the age of these logs he adds. "Black spruce, which is our principal export, does not make logs fit to cut much under 100 years, and I have counted 265 rings on a black spruce. The white spruce and pine grow quite twice as fast."

We attempt now to deduce from the collective evidence the limits of the Great Fire. At first sight the testimony appears somewhat conflicting, but this, I believe, is because two quite distinct ideas are associated with the name Great Fire of Miramichi. It seems plain that in early October, 1825, a large number of local forest fires were burning here and there over an extensive drought-stricken country, which embraced a great triangle with its apex near Fredericton, and its base on a line drawn from Belledune to Richibucto, (compare the accompanying map), some 6,000 to 8,000 square miles in area. The great northwesterly hurricane of the seventh of October fanned these fires to greater violence, extending and sometimes uniting them, so that they formed irregular patches and net-works scattered over the area, leaving however, very extensive tracts, especially in the river valleys, entirely unburnt. It is this general fire, or series of fires, to which the name Great Fire is sometimes applied. In certain special sections, however, the fires were of special violence and extent. This was the case with that which burnt the Cains River-Gaspereau region, and with those which burnt the great area, still barren, on the head of the Little Southwest Miramichi, the Sevogle, Northwest Miramichi and Nepisiguit, the most extensive area still open from burning in New Brunswick.* Most important of all these areas, however, partly because of the extent and violence of this particular fire, and partly because it involved so great a destruction of life and property, was that embracing the parish of Newcastle and vicinity, some 400 square miles in area, extending from the Square Forks of Sevogle and Mullins Stream easterly to the Bartibog, and beyond in a narrow tongue to near Grand Dune, and from Tomogonops and Portage River south to the Miramichi, which it crossed below Chatham to

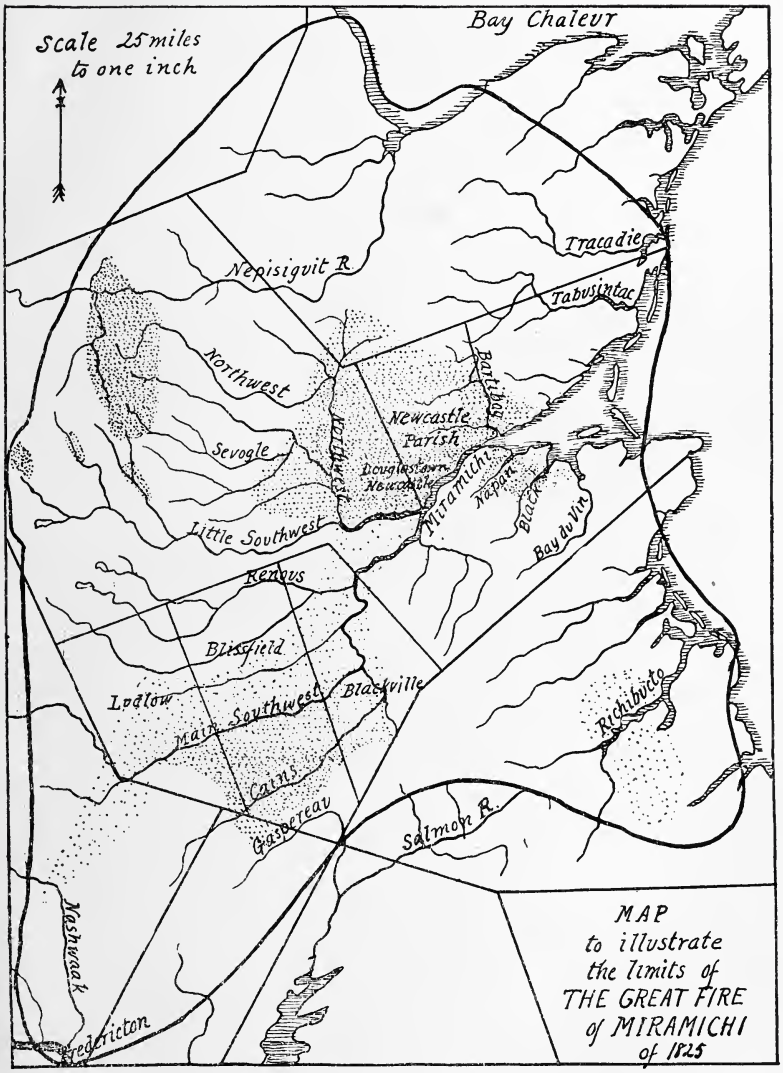
*It is of course not certain that this area was burned at that time, but certainly it was burned a very long time ago, and apparently no more recently than the country about the Square Forks of Sevogle, known to have been burned in 1825. Confirmatory of it are the various references, in the works cited, to the extension of the fire to, or towards Tobique. Perhaps at this time also the Graham Plains and Mitchell Plains country was burned on the Walkemik Branch (Note 87), as well as the burnt country on the North Pole Branch and the Lower North Branch.

devastate Napan and even Black River, though possibly the fires south of the river originated separately. It is this special fire which is also called the Great Fire of Miramichi. If we keep in mind this double use of the name Great Fire, the subject of the limits become fairly plain.

91. On a New Contour Map of New Brunswick.

Read March 7, 1905.

Up to the present time no contour map of the Province has been published. Nor, indeed, has any portion of it been thus mapped, excepting only the peninsula between Oak Bay and the St. Croix, which is mapped, with contours, on a United States chart, (see Note 14), the lower St. John valley which is thus represented on a crude steamboat circular, and certain small sections of interior New Brunswick thus mapped in the present volume of this Bulletin (pp. 216, 334). Also a single 200 of 220 foot contour is represented upon the Surface Geology maps. But otherwise vertical topography is shown on our published maps only by occasional and approximate hachures. Of manuscript maps I know but two showing contours,—Owen's fine map of 1841-43, showing the St. John from its mouth to Springhill, and a map of the Province which Colonel Maunsell tells me he made some years ago and sent with a report to the Militia Department at Ottawa. The latter map, I learn on inquiry at the Department, is in its possession, though its authorship is unknown, while the Report cannot be found. At length, however, the first published contour map of the Province has appeared. It is in the latest volume of the Transactions of the Royal Society of Canada (Vol. X., 1904), illustrating a paper of my own upon the causes determining the distribution of settlements in New Brunswick. It is on the scale of sixteen miles to an inch, and the contour intervals are 100 feet. It is constructed (a) from all accessible railway levels, (b) from all barometric measurements that have been published, (c) from my own observations in various parts of the Province, (d) from probabilities based on the



The heavy line indicates the area within which were the local fires often collectively grouped together as the Great Fire. The shaded places show known areas of fire, the definiteness and destructiveness being indicted by depth of shading. The Newcastle-Northwest area shows the extent of the Great Fire proper.

geological or physiographic construction of the country. Of course it cannot be accurate in details, and for two reasons. First, the data are wholly insufficient as yet for a fully accurate map; and second, the scale is too small to allow correctness in limited areas of much diversity. For example, the scale is much too small to allow the topography south of Nictor Lake to be shown as accurately as we know it; and this is true in many other places. Nevertheless, the map, I think, gives a correct idea of the general contours of New Brunswick.

92. The Fact Basis of the Fire (or Phantom) Ship of Bay Chaleur.

Read April, 4, 1905; re-written Jan 1906.

One cannot be long in the Bay Chaleur country, especially its eastern part, without hearing of the fire (or phantom) ship, said often to be seen on the bay. Until a short time ago I regarded the fire-ship as a pure fiction, with no basis other than the proneness of humanity to see wonders where they are expected, or where others say they exist. But as a result of two visits to that country, during which I questioned many residents on the subject, I have had to change my opinion; and I now believe there is really some natural phenomenon in that region which manifests itself in such a way as to be imaginable as a vessel on fire.

First we note the literature of the subject. Naturally the imaginative writers who have visited Bay Chaleur have seized upon the story of the fire-ship as a rare treasure, and, adding to the wildest local tales sundry fanciful imaginings of their own, with embellishments of banshees, pirates or picturesque historical personages, have produced weird fantasies such as are preferred to truth even by grown-up persons. A type of such stories is found in Miss E. B. Chase's *Quest of the Quaint* (Philadelphia, 1902), which connects the ship with the voyages of the Cortereals, making it a vessel set on fire by one of them when attacked by the Indians. From such a treatment there is every gradation, through many newspaper, guide-book and other accounts up to

serious descriptions of the phenomenon as something with a probable fact basis. The best account of the latter type that I have seen, written apparently by Mr. A. M. Belding, appeared some years ago in the St. John *Sun*. It reads in part as follows;—

> The extent to which a visitor may be impressed by the story of the phantom ship depends a good deal on the source of the information. Hon. Robert Young [of Caraquet] will tell you, for example, that frequently at night before a storm a large light may be seen on the surface of the bay. It may be seen in winter, when the ice has formed, as well as in summer, and it is not confined to any one portion of the bay. Sometimes it is much brighter than at other times and appears to dance along the surface. Joseph Poirier said he had seen it so bright that the reflection would appear on the houses at Grande Anse. Rev. Father Allard said he had seen it several times this season. In fact it appears to be quite a common phenomenon, though nobody is able to explain its cause..... Those who decline to place full reliance in this interesting story [viz. the fanciful legend] nevertheless admit that sometimes the mysterious light emits rays that shoot into and athwart the gloom, and might by a particularly well-nourished imagination be likened to the flame-lit rigging of a ship.

The information I have myself been able to collect from those who have seen the light is as follows. Of course I have sifted all testimony to the best of my ability, eliminating all exaggerations and embellishments, whether these be due to the habit of all humanity to make a story as big and good as possible, or to the common tendency to gull an impressionable stranger, or to mere ignorance, superstition or mendacity.

Four years ago Captain Turner of Riverside, Albert County, a clear-headed sea captain, told me, in answer to my mention of the fire-ship as a freak of the imagination, that he had himself seen it and hence knew it to exist. Later, on my first visit to Caraquet, I was told by a lady in whose word I have absolute confidence, that her attention was attracted one night by a light off Caraquet, which looked so much like a vessel afire that she supposed it to be one of her husband's schooners, and called him in alarm, only to find that it was the fire-ship. A prominent resident of Miscou, Mr. James Harper, told me he has seen it but once, in the winter on the ice off Clifton. It was seemingly some

ten miles away and kept rising and falling, dying down to a very small scarcely visible flame, then rising slowly into a column "looking thirty feet high." It was not in the form of a ship, but a column, but people told him it was the fire ship. He was told it preceded a storm, but he took notice and no storm followed. Mr. Robert Wilson of Miscou, who sails much on Bay Chaleur tells me he has seen the fire-ship, (or as he calls it, the "burning ship") several times. The time he was nearest it was about eleven years ago off Caraquet on a very dark night. The light appeared ahead, and finally he came near and passed within 100 yards to windward of it, so that he saw it with perfect clearness. It was somewhat the shape of a half-moon resting on the water, flat side down, or like a vessel on the water with a bowsprit but no masts etc., and "all glowing like a hot coal." He dared not run nearer and passed it, keeping his eyes upon it until far beyond. On other occasions he has seen it, at various distances, and has come to pay little attention to it. Sometimes it looked somewhat like a ship, sometimes not, and sometimes it vanished while he was watching it. Usually it is dancing or vibrating. Again he has seen it as one tall light which would settle down and rise again as three, which would again settle, and so on. Recently I have been told by Dr. J. Orne Green of Boston, whose connection with Miscou is mentioned below, that Mr. Wilson reports seeing the light this (1905) autumn; it appeared ahead of his boat as he sailed up the bay, vanished as he neared it, and in a few minutes re-appeared astern. Mr. Andrew Wilson, another leading resident of Miscou has also seen it, when it resembled a whaleboat, not a ship, in form. Mr. McConnell, keeper of the light at Miscou Gulley, tells me that he has seen the fire-ship, about two miles away, but it did not look to him like a ship, but more like a big bonfire. Several others have told me that they have seen it, (the great majority of the residents in the region averring that they have seen it at one time or another), most of them agreeing that at times it looks like a ship on fire, but that at others more like a round light. All agree that it usually precedes a storm, and is seen over the ice in winter as well as over the water in summer. On the other hand, other trustworthy residents of

Miscou, notably Mr. Jas. Bruno and Mr. Ed. Vibert, both of whom sail much on the bay, tell me they have never seen it, and do not believe in its existence.

So much for local testimony. But it receives confirmation from another source. For many years past Dr. J. Orne Green of Boston, a Professor in the Harvard Medical School, has spent several weeks on Miscou and has taken a great interest in all that relates to the region. He tells me that he has himself seen a light which he was told was the fire-ship. Many years ago when running at night towards Caraquet he saw a fire off in the bay, and called the attention of his companions to it, but finally thought it must be a woods fire on the north side of the bay. Reaching Caraquet, however, he found the people excited, because they said the fire-ship was out in the bay. He told them of his belief that it was a woods fire, but they declared this could not be, because it had moved. The wind at the time was gentle, from the southwest, but it was followed the next day by a great northwester. His interest being thus aroused Dr. Green, in later years, attempted to investigate the phenomenon. He found that it was reported not only in Bay Chaleur but also in the Gulf of St. Lawrence as far south as Northumberland Straits. He came to the conclusion that while the stories were mostly exaggerated and distorted there was nevertheless some basis for them in fact, and that there does occur in this region some natural light of the general nature of "St. Elmo's Fire." This was exactly the conclusion to which I had come independently, as stated in this note when originally read before this Society.

Grouping together all the evidence it seems plain,—*first,* that a physical light is frequently seen over the waters of Bay Chaleur and vicinity; *second,* that it occurs at all seasons, or at least in winter as well as in summer; *third,* that it usually precedes a storm; *fourth,* that its usual form is roughly hemispherical with the flat side to the water, and that at times it simply glows without much change of form, but that at other times it rises into slender moving columns, giving rise to an appearance capable of interpretation as the flaming rigging of a ship, its vibrating and

dancing movements increasing the illusion; *fifth,* its origin is probably electrical, and it is very likely a phase of the phenomenon known to sailors as *St. Elmo's Fire.*

I have, of course made efforts to ascertain if any such phenomenon is known elsewhere in the world. Professor R. De C. Ward, Assistant Professor of Climatology in Harvard University, writes me that he knows of no record of a similar phenomenon, and no development of St. Elmo's Fire so great that it could be mistaken for a burning ship. Professor A. H. Pierce, my companion in my visit to this region last summer, has, however, called my attention to references to an allied subject in the Journal of the Society for Psychical Research, XII, 1905, 108, and again in the Proceedings of the same Society, XIX, 1905, 80, where an account is given of lights claimed to have been seen around Tremadoc Bay in Wales; but the conclusion is reached that in all probability they have only a subjective basis, though the statement is also made that lights of unexplained origin were reported as common on the Welsh Coast over two hundred years ago. It is also of interest to note that Schmitt's newly-published Monographie de l'Isle d' Anticosti (57) mentions manifestations of St. Elmo's Fire observed at that Island.

It is plain that in this phenomenon we have a subject which invites accurate investigation. It can best be studied by a scientifically-trained person, a physician or other student accustomed to scientific evidence, resident at Caraquet or Grande Anse.

93. The Origin of the Northumbrian System of Rivers

Read in abstract May 2, 1905.

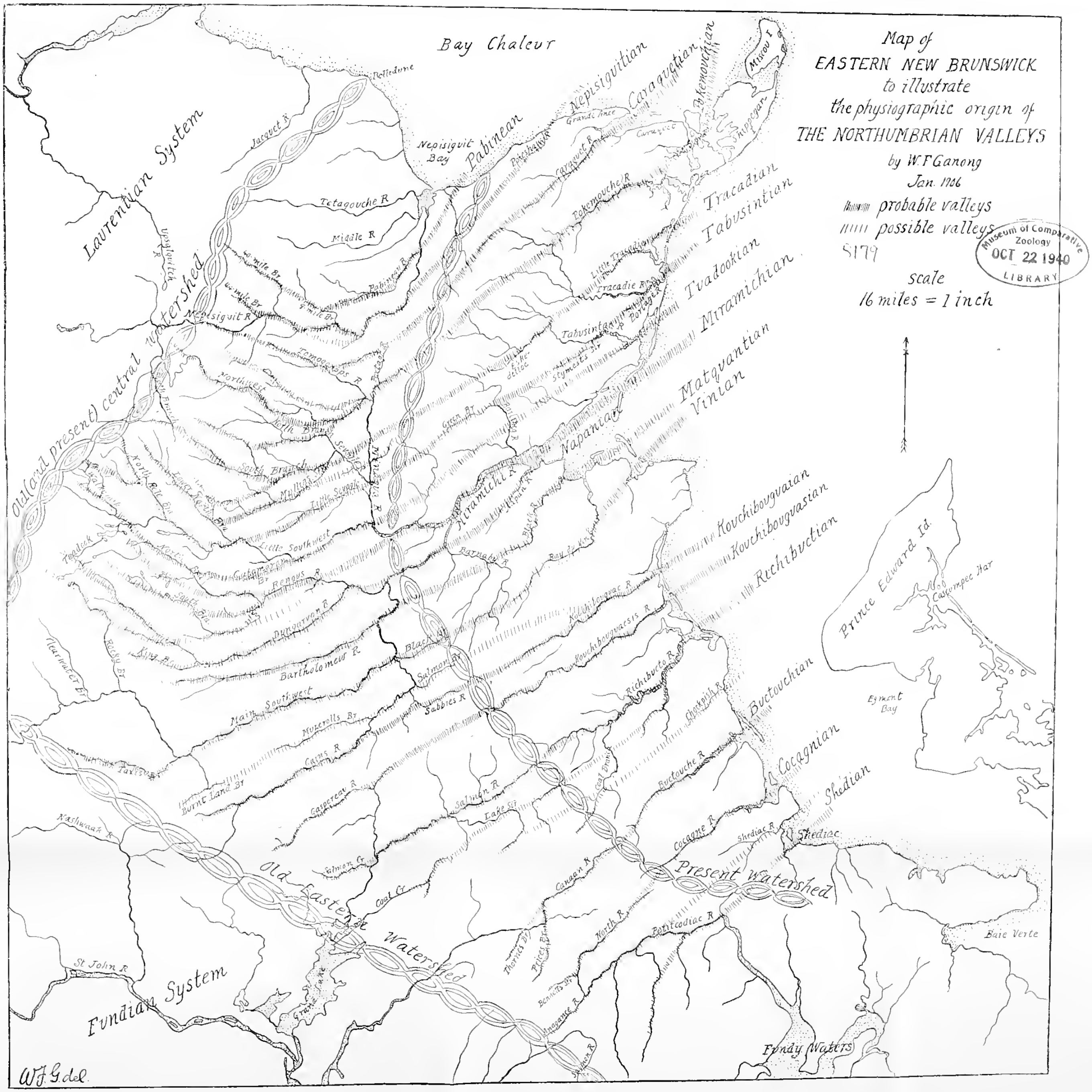
The most striking physical feature of New Brunswick consists in its abundant great rivers. These are, however, so diverse in direction, and interlock so complexly as to make the elucidation of their origin seem well-nigh hopeless. But prolonged study is showing that in reality they are derived from three primal systems, a Fundian system which I have described in an earlier note (No. 75), a Northumbrian System, which is here considered,

and a Laurentian System on which I hope soon to make some observations before this Society. I need hardly emphasize that the present paper is by no means final in its conclusions; like its predecessor it is rather intended as an organization of the available facts, and for the formulation of an hypothesis to serve as a guide for further study.

The system I call the Northumbrian (because lying principally in Northumberland County or else tributary to Northumberland Straits), includes all the rivers emptying into the Gulf of St. Lawrence from Bay Chaleur (but excluding the Restigouche) to Baie Verte, together with certain branches of the lower St. John which belong morphologically with them.

Viewing the system as a whole, we find that its valleys present certain resemblances and certain differences, the latter being marked enough to make it natural to consider them in some four groups, each distinguished by peculiarities of topography. By far the largest part of the system falls within the limits of the great central-eastern Carboniferous Basin of the province, a low plateau country having a gentle easterly slope and formed of soft undisturbed Carboniferous sandstones. It is in this basin that the rivers all have that parallel southwest-to-northeast course which is so characteristic, while the deviations from this direction are determined by the crystalline highlands either on the northwest or the south of the basin. But we can best consider the valleys in groups.

The first group of Northumbrian valleys embraces those from Shediac to Baie Verte, and extending thence into Nova Scotia, (compare the accompanying map). This group, however, I wish to reserve for further study, and will merely note here that I believe the original valleys headed in a line of crystalline highlands (an extension of the "Old Eastern Watershed") now represented by the Cobequid Mountains and the highlands of Albert County (this range being now cut completely across by Chignecto Bay). They emptied northeasterly to the present Northumberland Straits and across them and Prince Edward Island to the sea, the many inlets of the Island representing the remnants



of those old valleys. But the group of valleys has been so profoundly modified by the formation of the Bay of Fundy that much careful study will be needed to make its original relations clear.

The second group of valleys, however, is much plainer in its relations. It includes all those from the Petitcodiac-Shediac valley to the Main Southwest Miramichi. They all have this in common, that they lie in parallel courses from southwest to northeast wholly within the limits of the Carboniferous basin while the present rivers mostly head in line with branches of the St. John from which they are separated only by low divides, across which the original valleys no doubt extended. These divides, (the "Present Watershed" of the map), lie in a line running northwest between the Petitcodiac and Shediac, clear to the Main Southwest Miramichi, which it reaches just to the eastward of the remarkable right-angled bends of that river, after which it swings to the north across both branches of the Miramichi and then to the Northeast just east of the Northwest Miramichi (Minaqua) and Nepisiguit. This watershed, throughout its entire course is now crossed by but a single river, the Miramichi. The causes of this curious exception I have discussed in an earlier note (No. 54). In brief it seems due to the presence here of a great synclinal trough, parallel and homologous with the deep trough forming Bay Chaleur, the much shoaler trough in which lie Richibucto and Grand Lake, and the deep trough forming the Bay of Fundy. This watershed is obviously comparatively modern, and as it runs here parallel with the present coast, and hence with Northumberland Straits and with Prince Edward Island, I take it that the three latter all have the same origin, viz., low synclinal and anticlinal foldings parallel with the present seacoast. However formed, this watershed is of profound importance in the development of the Northumbrian Rivers, since it not only beheaded all those of the group we are considering, sending most of their upper courses into the St. John, but also beheaded those of the next group, both south and north of the Miramichi, turning their upper courses northward or southward into the Miramichi itself. But if the present watershed be modern, we

ask where was the ancient one, that which existed when the Northumbrian valleys were first formed? This I believe ran about as described in my Note on the Fundian rivers, namely in a line of hills (the "Old Eastern Watershed"), of which remnants still exist, extending from near Cape Wolf on the Bay of Fundy, northwesterly across the head of Grand Lake, and between the Nashwaak and Taxes to join the Central Highlands. Certainly all the facts known to me in connection with this subject seem to accord with this explanation. The ancient Northumbian valleys, therefore, would have headed on this Old Eastern Watershed; they extended northeastward including some branches of the St. John and all of our present North Shore rivers of this group; while they no doubt in part crossed Northumberland Strait and Prince Edward Island, the inlets of which match well with the continuations of our rivers. Between these valleys are the ancient ridges of erosion, parallel with the valleys, and manifesting themselves on the coast as the various projecting and more or less elevated headlands, some of which can be seen to match with the elevated and wider parts of Prince Edward Island.

We consider now the valleys of this group in order. My explanation of their courses is chiefly based on cartography, supplemented by information from other sources; it is not worked out upon the ground.* But the homologies seem so clear, and all the facts known to me so consistently in agreement, that I have no question as to its correctness in general, though I may be wrong in many details. A careful study on the ground will undoubtedly show the influence of glaciation in modifying details of the river courses, but the greater features of the rivers must depend upon other causes.

1. *The Shedian Valley.* This is the least distinct of the series, but all considerations of homology and cartographical evidence seem to indicate that the present upper part of the Petitcodiac formerly continued its

*In fact this country is all of such low relief, has suffered erosion of its soft rocks for so long a time, and is mostly so densely forested, that the tracing of ancient valleys by other than cartographical evidence will offer great practical difficulties.

course across to Shediac Harbor, (its present lower course being the result of capture by a Fundian river), either by the root followed by the present highway and railway to the southern part of the harbor, or else leaving the present valley below Salisbury and running across south of Indian Mountain to the Shediac River. Its head is of course in the Anagance, which rises on the old eastern watershed, and it may have relations with the Kennebecasis still to be worked out.* Its large southerly branches (which morphologically include the present head of Kennebecasis, or Salmon River), flow from the Southern crystalline Highlands precisely as many branches flow into the same basin from the similar Central Highlands.

2. *The Cocagnian Valley.* Headed in or near the present Bennetts Stream and included the present North River and Cocagne, probably continuing through Egmont Bay across Prince Edward Island.

3. *The Buchtouchian Valley.* Headed in the present Prices Brook, (or perhaps in Thornes Brook), which is strongly re-entrant to the present course of the Canaan, follows the upper course of the Canaan, crosses, (by the general route of the old Indian portage), to the Buctouche, along that river and probably across to Prince Edward Island, emptying through Cascumpec Harbor.

4. *The Richibuctian Valley.* Headed in the present Salmon Creek, which is strongly re-entrant to Salmon River, and included all Salmon River to the old Indian portage, across by its route, and by the Richibucto, and into the Gulf, north of Prince Edward Island.

A minor valley probably existed between this and the preceding, embracing a part of Coal Creek and Lake Stream, the upper part of Salmon River, and emptying by some branch into the Richibucto. Possibly another emptied by the Chockpish.

5. *The Kouchibouguasian Valley.* Headed in the present Gaspereau (captured later by a branch of Salmon River), followed along the course of Meadow Brook, and the extensive line of open barrens (which exist

*Of course, in still earlier times, the river which preceded the Petitcodiac and Anagance headed in the present Kennebecasis, as Dr. Matthew has pointed out in this Bulletin, XII, 54. But that was when the Carboniferous rocks were being laid down in a preceding geological and geographical cycle. As I understand it, all of our present rivers originated in a much later cycle, after all the rock formations of the Province had been laid down and were elevated again above the sea. It was, I believe, on this final elevation that the province possessed that three-plain or three-plateau structure which originated the three primal river systems, the Fundian, Northumbrian and Laurentian, while subsequent geological movements and erosions, supplemented by the glacial period, have altered the originally comparatively simple systems into their present complications.

here as I am informed by Mr. P. H. Welsh), into the Kouchibouguacsis and thence to the sea.

6. *The Kouchibouguian Valley.* Headed in the upper parts of Cains River, (possibly beyond in a part of the upper Nashwaak), crossing to East Branch Sabbies River, thence to the Kouchibouguac and so to the sea. It is likely that another valley headed in Burnt Land Brook, and included Muzeroll's Brook, a part of Cains River and Salmon Brook, and then either entered the Kouchibouguac or else the Vinian Valley.

We consider now the third group of the Northumbrian Rivers, those beginning with the Main Southwest Miramichi and extending to, but not including, the Nepisiguit. I have been able to study personally several of these, with results recorded in previous notes of this series, in one of which (No. 54) I have given an outline (differing somewhat in details from that here presented) of the physiographic history of the Miramichi. These rivers all have these important features in common, that their upper courses are not, as in the preceding group, in the line of their lower courses, but instead they head in the crystalline Central Highlands and flow approximately parallel (though with interrelationships still to be worked out) from northwest to southeast, until, reaching later and softer rocks, they swing by long curves through a right angle, flow for a space across the Carboniferous basin in the characteristic southwest to northeast direction, and then suddenly, although still in the same formation, swing at right angles, some to the north and some to the south, into a single trunk river, leaving their original lower courses to be occupied by much smaller rivers emptying northeastward into the sea. These smaller rivers all turn, near their mouths, towards Miramichi Bay, as a result no doubt of the fact that this Bay lies in a synclinal trough (already mentioned), down the slopes of which the rivers naturally tend to turn. The heads of these rivers in the Highlands, though they have undergone some changes in detail, are, I believe, the original heads, and the old central watershed and the present one are identical, excepting that it is now crossed by the South Branch Nepisiguit and the Main Nepisiguit River, a condition earlier explained (Note 70). The great curves do not occur exactly at the contact of older with

newer strata, but approximately so. The presence of these curves would seem to indicate that the older rivers flowing radially out of the Central Highlands, here met the ancient Carboniferous Plain, which, having an even slope northeast, carried the rivers in that direction, a feature which speaks for a somewhat ancient origin of the system. These curves are not in all cases in their original positions, as I have shown in some of the earlier notes on these rivers, and as the cartography of others seems to imply. The reasons for the remarkable turning of all the lower courses of all these rivers into the single Miramichi are fairly plain and have already been indicated. It is due to the pre ence of a great north and south depression beginning in Nepisiguit Bay (which owes its existence to it), and running south along the present course of the lower Nepisiguit, Portage River, the Northwest Miramichi, the several right-angled bends of the Main Southwest Miramichi, including Cains River, and perhaps even showing in some of the branches of Salmon River.* This great depression, which is parallel with the watershed just to the eastward of it, and with the sea-coast, is, no doubt, either a shallow syncline or a great fault line, formed in times comparatively recent. The fact that north of the main Miramichi it is occupied by a single valley (which from its Indian name we may call the Minaqua), collecting the streams from the west, while south of the Miramichi it is not a single valley but rather the turning of the streams into one another, is probably due to the fact that the syncline, with its anticline on the east, is less marked to the south and more marked towards the north.

We consider now the valleys in detail. The upper part of the first of them, the Main Southwest Miramichi, and its relations with the Nashwaak and Taxes, are puzzling, and I reserve consideration of them until I have been able to study them upon the ground. Aside from this, however, the courses of most of the valleys are fairly plain.

*Or, continued through the Gaspereau, Grand Lake and the lower St. John, it forms one of the great lineament lines of Eastern North America, discussed by W. H. Hobbs, in the report of the Eighth International Congress, (Washington, 1905, 193).

7. *The Vinian Valley.* Headed in the Taxes, following the Main Southwest to the mouth of Cains River, then by Black Brook and a part of Barnaby River (the waters of the two latter streams coming much closer together than shown upon any printed map, *fide* MS. plans in the Crown Land Office), thence to Bay du Vin River, which apparently formerly emptied through Lower Bay du Vin, as shown on the map.

8. *The Matquantian Valley,*—(from the Indian name, Matquanticook or Black River). Headed in Bartholomews River, (which does not now head in the Highlands, but which further study will probably show to have done so), along Bartholomews, a short reach of the Main Southwest, the Semiwagan and Black River, which emptied south of Vin Island across the present position of Fox Island.

9. *The Napanian Valley.* Headed in the Dungarvon, probably in King Brook (though perhaps in the Upper Tuadook, Note 86) and thence along Dungarvon to the Main Southwest as far as Barnaby River, thence across to the Napan and Miramichi Bay.

10. *The Miramichian Valley.* Headed in the present upper Dungarvon and beyond in the upper waters of Tuadook and Rocky Brook (Note 86), probably across to South Branch Renous, with Branches as shown on the map, and by Renous, and across to the tidal part of the Little Southwest as shown on the map, and thence along the present Miramichi and along the north shore of Miramichi Bay, thus forming the axial river of the system. The complicated relations of the South Branch Renous and Dungarvon are uncertain, and perhaps the headwaters of this valley belong with the present Dungarvon.

Such seems to me the most probable arrangement of these valleys from such data as I have at hand. It is however possible that the arrangement may have been different in detail. Thus a part of Cains River may have run into Bay du Vin River, the Taxes and Main Southwest into Black River, Bartholomews into Napan, Dungarvon forming the axial river. Or the Dungarvon may have flowed by Stewarts Millstream. I have no question whatsoever that a careful study on the ground, or the possession of accurate contour maps of the region, would enable us to settle these questions, at least to a high degree of probability.

11. *The Tuadookian Valley.*—From Tuadook, the Indian name of the Little Southwest Miramichi. Headed in the Tuadook Lake region, and no doubt in the Walkemik Basin (Note 87), the connection of this basin with the present Little Southwest Miramichi (with a preglacial course through Mains Lake and Brook, Note 54) being much later in origin; followed the North Branch Renous (Note 85), to McKendrick Brook, by

the valley of which it swung to Catamaran Brook and the Little Southwest Miramichi. Its course beyond that it obscure, but the general parallelism, sustained by certain features of the smaller streams, would suggest a continuation of its course parallel with the present north shore of Miramichi Bay to French Cove and thence to the sea through Tabustintac Lagoon.

12. *The Tabustian Valley.* Headed in the North Pole Branch (and probably in its Half Moon Lake branch, Note 99), followed the North Pole Branch across its big bend to near its mouth (Note 54) where its old course was in line with the Little Southwest below, thence along the Little Southwest, bending gently north of its present post-glacial angle (Note 54), thence to opposite Little Sevogle and across to that stream, along it and across country to Green Brook, thence to Stymests Millstream and thence to Portage River and into the sea by the present course of the Tracadie (Note 94).

13. *The Tracadian Valley.* Headed in the South Branch Sevogle and perhaps beyond in the West Branch of the Main South Branch of Nepisiguit (as will be shown in a later note), and with another branch heading in the Lower North Branch (and perhaps beyond in the uppermost course of the present North Pole Branch, Note 99), and following Mullins Stream, across country south of the Square Forks to the Eskedelloc and a part of Tabusintac, across the Tracadie near Head of Tide (Note 94), and by Little Tracadie to the sea near Green Point, (or possibly through South River, Pokemouche).

14. *The Pokemouchian Valley.* Headed in the Main Northwest Miramichi, receiving branches as shown on the map; and by the Main Northwest, the East Branch Portage River, across to a basin near Meadow Brook on the Tracadie (Note 94) and along the Main Pokemouche to St. Simons Inlet and Shippegan Harbor to Bay Chaleur.

15. *The Caraquetian Valley.* Headed in the Tomogonops (and possibly even in a part of the Nepisiguit near Indian Falls), swings to the south branch Portage River, thence to the source of the Tracadie and across to the Caraquet (Note 94) and thence to the sea.

Such seem to me the most probable courses of these ancient valleys, though here again, while believing in the correctness of my explanation in general, I think it likely that considerable error may exist in details. Such an arrangement of ancient valleys would not only bring this whole series of rivers into homology with those in an identical geological formation south of the Miramichi, but at the same time explains the reason for the re-entrant directions of the rivers flowing into the Minaqua River, a feature

otherwise very difficult to explain, and also the reason for the peculiar northeast direction of parts of the Bartibog, Tabusintac, Portage River and Little Tracadie, and for the curious course of the Caraquet parallel with the coast of Bay Chaleur. The correct linking of the valleys east and west of the New Eastern watershed is rendered very difficult by the changes which have been brought about by the considerable height of that watershed (at least 535 feet by railway levels), and also by subsequent changes, in part glacial, in the courses of the Pokemouche, Tracadie (Note 94) and Tabusintac valleys. The lower courses of these streams, no doubt following the slope of the syncline trough forming Miramichi Bay, have been swung directly eastward across the low ridges separating the ancient valleys (compare Note 94). All of the intervening ridges can be traced near the sea;—thus the Tuadookian-Tabusintian ridge shows in the elevation east of Portage River; the Tabusintian-Tracadian in the elevated ridge on which Tracadie Village and its church now stand; the Tracadian-Pokemouchian, the highest and most important of all, extends out to form Shippegan and Miscou in one direction, and southwesterly to cross the Minaquan valley near Chaplins Island, causing there the wide separation of the mouths of the Northwest Miramichi and the Sevogle; the Pokemouchian-Caraquetian comes to the sea in the cliffs of Caraquet; and the Caraquetian-Nepisiguitian (the latter mentioned below) in the cliffs at Grande Anse.

We consider finally the fourth group of these Northumbrian Rivers, including the small rivers north of the Nepisiguit to Bay Chaleur. Though short, they all show the right-angled bends on their issuance from the crystalline highlands, followed by a northeasterly course showing a certain homology with the valleys to the south of them. Then in their lower courses they are swung northward into Bay Chaleur, by the same causes which turned the rivers to the southward into the Minaqua valley, namely the elevation of the New Eastern Watershed immediately on the east. The recognizable valleys are the following;—

16. *The Nepisiguitian Valley.* Headed probably in or near 44-mile Brook, and followed the general course of the present Nepisiguit to below

Grand Falls. Thence, I think, it flowed, parallel with the valleys south of it, across to the Pokeshaw, which now runs in a remarkably trough-valley parallel to the coast.

17. *The Pabinean Valley.* Headed in the upper part of 40-mile Brook, continuing across to Nine-mile Brook, bending in the latter to enter the Pabineau, which perhaps at first crossed to near Salmon Beach, but early formed the lower course of the present Nepisiguit.

Northward of this valley traces of the same arrangement, including the bends (now less marked because these rivers radiate from the highlands rather to the east than the southeast), may be seen in Little River, Middle River, the Tetagouche and others nearly to Belledune. Their lower courses no doubt flowed northeasterly over a plain of Carboniferous rocks now replaced by Bay Chaleur. North of the source of the Tetagouche, however, the crystalline Highlands come to an end, though an extension of them in Silurian rocks forms that notable swelling into Bay Chaleur centering in Belledune. North of Belledune the rivers all belong to the Laurentian system, later to be considered.

94. The Physiographic Characteristics of the Tracadie River.

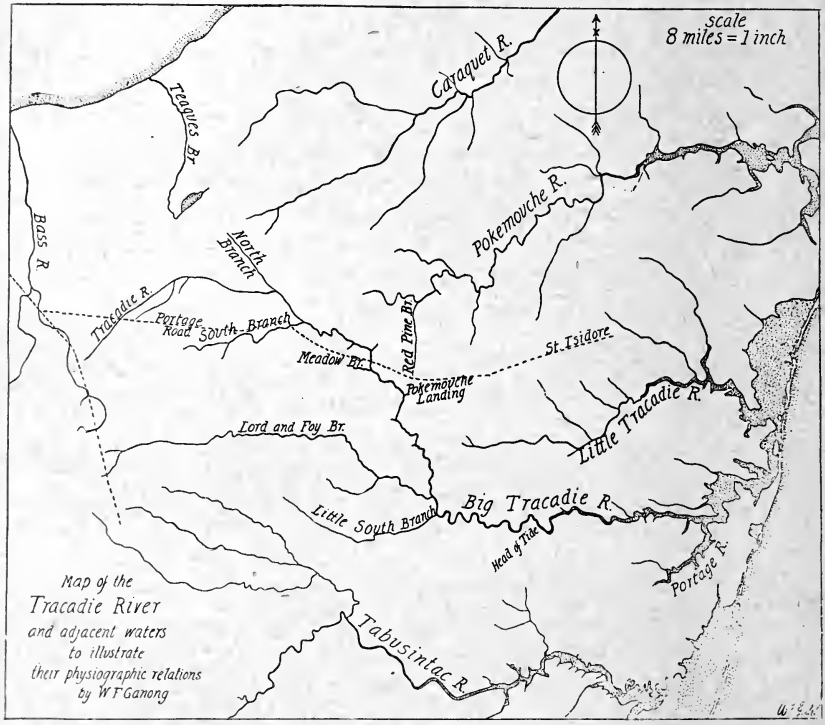
Read December 5, 1905.

In the northeastern section of New Brunswick are several considerable rivers, the Tabusintac, Tracadie, Pokemouche and Caraquet, about which hardly a word is to be found in all our scientific literature. Yet these streams are of great interest, not only for what they actually are, but also for their bearing upon the most important and alluring problem in all the physiography of this province, the mode of evolution of its three great primal river systems. It was therefore with the keenest delight I was able to study the principal one of the series, the Big Tracadie, during a canoe trip* from near its head to its mouth in August

*I was accompanied by my friend, Professor A. H. Pierce. We were portaged from Bathurst via the Bass River and portage roads to the mouth of the South Branch. I discovered too late for a change of plan that we might have descended the river with no great difficulty from near its source, where it crosses the portage road.

last. Such results as I found of interest are recorded below, and are further illustrated on the accompanying map.

The development of our knowledge of the river may be briefly traced. Its name, which perhaps was extended to the river from the region of its mouth by the whites, is Micmac Indian, meaning, probably, "camping-ground," descriptive of the extensive occu-



pancy of Tracadie by the Indians in early times. It is first mentioned, not as a river but as a place or port, by Champlain in 1604; and thereafter it appears upon substantially all maps down to the present day. No attempt however was made on the early maps to represent the river, except by an occasional crude and conventional sketch, until after it was surveyed in 1838 by David Sadler, whose large-scale plan in the Crown Land Office, show-

ing the river from Portage River nearly to the head of the South Branch (viz. the upper South Branch), is the original of all later published maps down to the present day. The part above the South Branch has never been surveyed, but is simply sketched from intersections of timber-lines; it is represented very badly upon all printed maps, but more accurately upon the timber-plans in the Crown Land Office, from which the accompanying map is taken. The lower course of the river, from three or four miles above Portage River, was only sketched by Sadler, and his imperfect draft is followed on all printed maps. That part is given more correctly from land surveys on plans in the Crown Land office, followed on the accompanying map. The Big Tracadie was not settled until after 1800, though the Tracadie Settlement, at the mouth of the Little Tracadie*, is much older. The settlers are almost entirely Acadian French, who have extended slowly up the tideway until now their uppermost pioneer settlements reach to within two miles of the head of tide. All of the remainder of the river is still a wilderness. It has always been noted as a valuable lumber river, and some lumber of the very finest quality is still being taken from its headwaters, though locally it is said to be almost exhausted.

Another notable Tracadie feature, less striking now than formerly, is its wonderful trout-fishery, especially for sea-trout in its lower course. For this reason it has been much visited by sportsmen, and mention of it occurs in several angling books and especially in the Reports and other writings of M. H. Perley. Scientifically however the river seems not at all studied. I can find no mention of it in any scientific writings accessible to me, even the geological reports containing not a single reference to the river.

The Big Tracadie River rises in a tiny spring rivulet close to the Bathurst Road, as I am told by Mr. Frank O'Connor of Bass River, who knows the Tracadie thoroughly, and to whom I am indebted for much important information about it. It flows northeasterly, rapidly enlarging, until at the crossing of the

*The history of the founding of Tracadie, with a large scale map of the mouth of the Big Tracadie, are given in a forthcoming paper by the present writer in Trans. Royal Society of Canada.

portage road (see the map), it is a meadowy stillwater stream, navigable even at low water for a canoe, winding at the bottom of a wide trough-like mature-looking valley of moderate depth (perhaps 40 to 50 feet below the general level of the country). Mr. O'Connon tells me it preserves this character for several miles to the northeastward, indeed, to and around its easterly bend. Now this valley, as will presently be shown, is very much older in appearance than any part of the Tracadie below it; and furthermore it was obviously formed by a very much larger stream than that which now occupies it. It must be a fact, therefore, that it does not represent the original head of the Tracadie, but is part of an older northeast-southwest valley. Our best maps (the timber-line plans of the Crown Land Office, followed by the accompanying map), show that this valley lies exactly in line with the present Caraquet valley, and I have no doubt they are parts of the ancient *Caraquetian Valley* described in the preceding note, (No. 93), where also the position of its probable head in Tomogonops-Portage River is discussed.

The great bend of the Tracadie to the eastward I have unfortunately not seen. At the uppermost point I reached in ascending the stream on foot from the South Branch, viz., just east of this bend, the stream is of a meadowy, smoothwater, winding, sand-bottomed type, a character which it holds, as Mr. O'Connor tells me, all the way from the portage road. But the valley here is much narrower, steeper-walled and newer in appearance than is the part above, and also deeper, perhaps 70-80 feet below the general level. Descending, the country becomes somewhat lower, and the river becomes gradually swifter and shoaler, rippling in a clear stream over gravel and small stones, sometimes carving into high banks of glacial drift or of the greatly-jointed soft gray sandstone which constitutes the bed rock of the entire valley of the Tracadie. It continues thus down to the North Branch. This part of the river has more drop than any other part of the main Tracadie, and under present conditions would form difficult canoeing at low water. But the present character of this, as of many other New Brunswick streams, is no index to its original character, Mr. O'Conner has told me from his personal

knowledge of this river, and I have been told by other lumbermen of other New Brunswick streams, that the great quantities of logs now driven at a time down a stream, especially when supplemented by the great rushes of water when the splash, or driving, dams (of which there are several on the Tracadie) are opened, cause an extensive tearing away of the soft banks, making the river-beds much broader and much shoaler than they were originally. This subject should be kept in mind in studying the ancient routes of Indian travel, and will explain why several New Brunswick routes were much used by the Indians where now a canoe could be taken only with very great difficulty, or even not at all.*

The North Branch, so far as I have seen it, some two or three miles up, is also in large part a meadowy, sand-bottomed, smooth-water stream, up which even now in low water a canoe could be worked with little difficulty. The valley, which is some 40 to 50 feet below the general level of the country, though small, is moderately open and mature; and, since it continues exactly the direction of the main Tracadie below it, I have no doubt it is morphologically the head of the Tracadie, while the present main stream, from the mouth of the North Branch northwesterly to the great bend, represents a branch which has worked back across the ancient watershed and captured the head of the Caraquetian Valley.

Below the North Branch the combined streams form a shallow, rippling, cold and clear-water river, winding somewhat in an open and seemingly rather mature valley, washing at times against high glacial banks or low cliffs of sandstone, the jointed pieces of which are washed out to form small angular boulders in the stream. These small sandstone boulders are practically the only ones found throughout the length of the Tracadie, the granite or other crystalline boulders of the rivers of the interior being here quite wanting. Such is the Tracadie down to the South Branch.

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*Possible Indian routes from the Tracadie to Bay Chaleur are discussed in the paper cited in the preceding footnote.

The South Branch I have seen only for a mile or two above its mouth. Mr. O'Connor tells me it rises in three tiny clear lakes, whence it flows eastward with considerable drop, falling at times over rocky ledges or swiftly over stones and gravel, with little stillwater upon it. As far as I have seen it, is a swift shallow stream, in a somewhat narrow valley. Evidently this is a new, if not possibly post-glacial, branch of the Tracadie, draining the eastern slope of the elevated ridge, some 100 to 150 feet above the streams, crossed by the portage road. This ridge, I believe extends southwest to form the watershed between Nepisiguit waters and Tracadie-Tabusintac waters, and northeastward to separate Caraquet from Pokemouche waters, reaching the sea in the elevated land and cliffs at Caraquet. It is in fact the separating ridge between the ancient Caraquetian and Pokemouchian valleys of the primal Northumbrian system (Note 93).

Below the South Branch the river is of course enlarged, and, except for occasional bars, becomes readily canoeable even at low water, despite its shoaling through lumbering. It winds in a somewhat open valley, with a rippling flow and occasional little rapids over gravel, sand, and small stones with occasional glacial or sandstone banks, while gradually pools appear, sand-bottomed and temptingly trout-haunted in the clear white-water depths. The banks, as everywhere above, are densely wooded, and the entire river very attractive. Descending, the stream becomes gradually quieter, sand-bottomed pools are more frequent, smoothwater prevails, the banks are of alder and meadow, the valley opens out more and more, until a mile or more above Meadow Brook the river is winding in a pleasant open intervale basin, which has been partially cleared for camping purposes on the line of the Bathurst-St. Isidore portage road, which crosses here. Descending farther, the river begins to grow swifter again, gradually coming to ripple over a gravelly and stony bed; the valley walls rise rapidly and close in to the river bed, until at Pokemouche Landing, two miles below Meadow Brook, the stream enters a deep gap cut sharply into an elevated plateau, entirely different from anything above.

What now is the origin of the Tracadie down to this point? Since the entire river runs through rocks of uniform hardness (the soft gray Carboniferous sandstones), it is plain that the parts of the river above and below this meadowy basin, being so different in their character, must have had very different origins. Turning now to the maps we notice that the Pokemouche waters here approach very near to the Tracadie, especially at the bend of Tracadie a mile above Meadow Brook; further we note that the Meadow Brook basin lies directly in line with the main valley of the Pokemouche; and further that the Tracadie above the basin is parallel with the northerly branches of the Pokemouche, while (to a slight extent at least) the Tracadie below the basin is parallel with southerly branches of the Pokemouche. All facts taken together seem to make it probable that the Pokemouche formerly flowed across this basin, and the Upper Tracadie was one of its branches, while possibly the Tracadie for a short distance (a mile or two) below the basin was another. This idea falls in perfectly with the theory advanced in the preceding note that the Pokemouche occupies the eastern end of another of the great primitive Northumbrian valleys,—the Pokemouchian Valley, which, extending across this basin, headed in Portage River and the Northwest Miramichi. As to the cause of the turning of the upper Tracadie from the Pokemouche southward into its present course, it is very likely, as will be shown below, that this is in some way a result of the glacial period; and I venture the prediction that the watershed between the Tracadie basin and the Pokemouche waters to the eastward will be found to be formed by a line of glacial drift thrown across the ancient Pokemouchian valley.

Below Meadow Brook, as already noted, the character of the valley changes greatly, the valley walls rising rapidly, until at Pokemouche Landing, two miles below Meadow Brook, the river enters a remarkable gap in a flat plateau. Descending, the valley zigzags abruptly, and its walls rise higher and higher, so steeply withal as to become in places almost of a gorge-like character, with occasional nearly vertical sandstone cliffs. These features become more and more pronounced until, about half way between

Pokemouche Landing and Lord and Foy Brook, the river is running at the bottom of a deep V-shaped valley cut sharply into the surface of a very flat plateau. Nowhere in New Brunswick have I seen a valley so sharply cut into so level a country, features which can be plainly seen since the entire region is burnt to a barren. Below, the country falls off somewhat and the valley opens a little down to Lord and Foy Brook, which, itself in a similar deep valley, enters the main stream in a very pleasant intervale basin. Below this stream the character of the river remains much the same, the plateau becoming slightly lower but the valley remaining narrow down to the Little South Branch, where the entire river swings abruptly to the eastward. Such a character for the valley suggests a rough river bed, which, however does not occur. The flow is somewhat swifter than above, and a few small rocky rapids occur; but for the most part the river runs rippling over gravel or stones, or smoothly through swiftwater pools, a remarkably easy and very charming stream for the canoeman. This part of the river certainly has an attractiveness of its own, especially in the contrast of the pleasing stream and its dense margin of woods with the wildness of the great bare, steep, abruptly-winding rocky valley walls, sharply lined above by their angle with the plateau. But while the valley is narrow, the bed of the river, which is always over drift, never quite fills it, and narrow strips of alluvium occur on one side or the other, with considerable intervale points at the bends.

We consider now the origin of this part of the river. Evidently it has cut directly across a plateau-ridge which is highest half way between Pokemouche Landing and Lord and Foy; and this ridge, I take it, extends southwestward with the sources of the Tabusintac upon its southern slope, and northeastward between the Pokemouche and Little Tracadie, reaching the sea at the upland Green Point, and extending beyond to form the islands of Shippegan and Miscou. It is thus one of the ancient ridges separating the Pokemouchian and the Tracadian Valleys of the original Northumbrian system of rivers (Note 93). But what sent the Tracadie across this ridge? It was, I think, changes

connected with the glacial period. Although the valley is obviously not post-glacial, nevertheless its sharpness of angle and evident newness seems to admit, in view of the softness of its rocks, of no greater age than the glacial epoch. The entire valley has the characters and the appearance of those parts of the Nepisiguit, and of the Northwest Miramichi, which I have described in earlier notes as "inter-glacial," (or perhaps one should say, "sub-glacial") valleys. I have no doubt these streams are all of the same origin, and all connected with glacial phenomena, and the determination of the exact origin of one will give the explanation of them all. It is very likely that the damming of the old outlet through the Pokemouche, whether this was by glacial ice or solid drift, sent the waters over the lowest point of the plateau to the southward, which point would naturally lie where streams on its northern and southern slopes approached one another at their heads. Thus it is very possible that the comparatively straight reach of the Tracadie below Pokemouche Landing was originally the head of Red Pine Brook, for not only are they in a direct line, but, as Mr. O'Connor tells me, the source of Red Pine Brook is here within a mile of the Pokemouche. On the other hand the part of the Tracadie south of the highest part of the plateau, at least the part for a mile or two above Lord and Foy, was very probably in pre-glacial times simply a branch of the present lower Tracadie below Little South Branch, as was Lord and Foy itself. But more detailed study is needed to determine these interesting details.

The Little South Branch also runs in a narrow valley, cut deeply into the plateau. Its direction continues that of the river below it, of which probably it is the morphological head. Below it the Tracadie valley down to the tide is very much wider than anywhere above, wide enough so that the river winds sinuously back and forth from wall to wall around great intervale points, the windings shown on the map being of this minor character and not major windings of the valley itself. But the valley walls are fairly steep (aside from the places where the stream is obviously cutting into them and forming cliffs), and the plateau

holds its height of from 70 to 80 feet for some distance to the eastward, and then falls off markedly towards the tide-head where it is not over 30 to 40 feet above the water. The bed of the river is yet smoother than above, consisting chiefly of long smooth-water pools and smooth-running reaches over sand and gravel, separated by rippling gravel bars and occasional little rocky rapids. Finally, growing yet smoother and quieter, it merges imperceptibly with the tide, the transition being marked only by stranded and water-logged river drift. Below, along the tideway, the valley preserves in general much the same character, though broadening somewhat, but the walls gradually become higher, the plateau rising again to some 70 or 80 feet above the water. Then it sinks again, until, some three miles above Portage River, it has dropped to 40 feet or less, after which it seems to fall away still more abruptly, to dip rapidly under the waters of the Gulf of St. Lawrence. Through all of its tidal part the river winds considerably, with banks at times of glacial drift, again of sandstone cliffs, but oftenest gently sloping and thus affording sites for the thrifty farms which are extending gradually up the tideway. Often, when the banks are high, it has much of a fiord-character, and everywhere it presents much quiet beauty of scenery. Near the mouth of this easterly part there comes in Portage River, in a ripe-looking tidal valley nearly as large at that of the Big Tracadie. The Tracadie then bends northward through "The Lake" and finds its way to the sea through a complex of lake, cove, point, lagoon, marsh, island and sand beach, all thoroughly characteristic of a sinking coast in a sandy region.

We consider now the origin of this part of the river. It is just possible that it is of the same age and mode of formation as the part above to Meadow Brook; but its much greater size, appearence of greater maturity and marked difference of direction, all indicate that it is considerable older, and I think it is a long pre-glacial, though still comparatively modern river. It cannot however occupy an original valley of the Northumbrian series (Note 93) partly because it is too new in character and partly because its direction is nearly due east instead of north-

east. Furthermore I believe a Northumbrian valley can be traced directly across it, for the Eskedelloc and upper Tabusintac, the depression in the plateau about the head of tide on Tracadie, and the course of the Little Tracadie all lie in a line, and that in the direction proper for the old Northumbrian series (Tracadian Valley of the preceding note). In its easterly, instead of northeasterly direction, it is not unique, since the Pokemouche, to some extent the Little Tracadie, and the Tabusintac, also show this easterly, or even southeasterly, direction for their lower courses, though the Northumbrian valleys can be traced in the northeasterly direction. These easterly courses I presume are connected with the formation of the great trough originating Miramichi Bay, a syncline parallel with Bay Chaleur and Bay of Fundy. It is on the slope of this syncline, I take it, these rivers have been formed, thus acquiring their present directions which represent a compromise, as it were, between the original northeasterly slope of the country and the southeasterly slope of the syncline walls. In pre-glacial times, no doubt, the Tracadie emptied directly eastward just north of Point a Barreau, but since the Glacial Period has emptied through one of the old Northumbrian valleys, a continuation of that of Portage River, the Tabusintian Valley of the Northumbrian system.

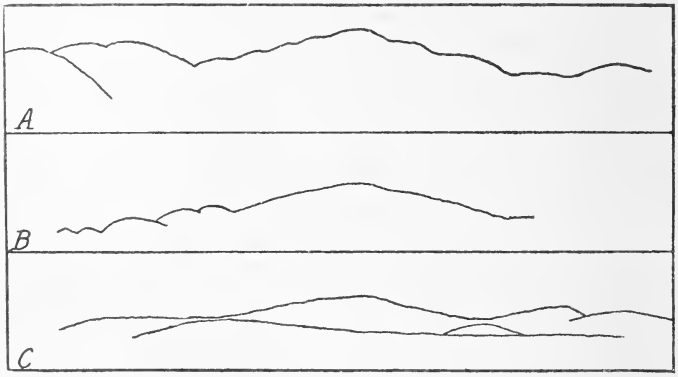
95. On the Height and Other Characters of Wilkinson Mountain.

Read December 5, 1905.

Near the source of the Walkemik, or Upper North Branch, of the Little Southwest Miramichi rises Wilkinson Mountain, one of the highest and most important mountains of New Brunswick. In my description of this region in Note No. 87, I gave some account of it, and mapped its approximate position,* but I had not then been on its summit. In July last I was able to ascend it, measure its elevation, and make some other observations which follow.

*As thus mapped it is somewhat too far from Hough Lake; compare the map accompanying Note No. 99 following.

An aneroid measurement made with all the precautions described in earlier notes, and checked for weather from the Fredericton and Chatham stations, made it 2572 and 2524 feet respectively above mean sea level. Its height measured from our camp, the elevation of which was determined by two measurements checked from the two stations, was 2438 and 2424. The mean of these four is 2489 feet. This agrees well with a direct aneroid measurement (910 feet) of its height above Dunn Lake, of which the elevation (1572 feet) was determined last year, and with the fact that it is somewhat higher than the neighboring Thunder Mountain which I made 2468 feet in 1900. My figures are certainly conservative and under rather than over the true amount, so that I have no question this mountain will be found



Sketches of Wilkinson Mountain from a distance. A. From near the southeast angle of Holmes Lake; Thunder Mountain (the double top mountain) is visible on the left. B. From a bare hill above the big bend on the North Pole Branch. C. From Little Nalaisk Mountain on the Serpentine.

to reach fully 2500 feet. Like Carleton and others of our higher mountains, it suffers in apparent height from the fact that it rises from an elevated plateau, itself 2000 feet and more in height. Thus I made the plateau some three miles northwest of it over 2200 feet (Note 98 following). It stands at one end, and Carleton-Sagamook at the other, of the most elevated watershed in New Brunswick, the very roof of the province, that separating the Serpentine from the Nepisiguit and Miramichi waters.

So gradually does the mountain rise above its surroundings that its summit cannot be seen from anywhere in the near vicinity, but its form and relations to neighboring hills can be determined only from a distance, or from its own summit. As to the latter, it affords unfortunately no good view, because it is densely wooded; but from a precarious perch on a tall tree I was able to see that it forms the culmination of a marked ridge much higher than any other land in the vicinity, and of which Thunder Mountain is the southwestern end. As to its appearance from a distance, it is in no respect striking or distinctive, aside from its obvious elevation above all other land in the vicinity. I find happily that I have preserved in my notes sketches of its form as seen from three distant points from which it shows clearly, and these sketches are reproduced in the accompanying cut. The mountain appears to be formed entirely of granite, for all its boulders are of that material, and granite ledges occur upon its flanks, as recorded in Notes 87 and 97.

96. Observations upon the Weather of the Central Highlands.

Read December 5, 1905.

During several journeys into the central highlands of the province, I have taken some note of weather conditions, especially as to temperature. In working out the details of various aneroid measurements I have noticed that the temperatures taken with the readings average, as would be expected, markedly lower than those at the central stations at Fredericton and Chatham. I attempted in 1904 to make somewhat exact measurements of minimum night temperatures, but owing partly to a defective instrument and partly to an erroneous method, my somewhat elaborate results proved worthless. But in July, 1905, I attempted to make these measurements with proper methods (hanging the thermometer always over five feet from the ground in an open space), and with a carefully standardized instrument (a Hicks form re-scaled in comparison with a standard thermometer). Unfortunately my trip this time was very short, but the temperatures,

as far as they go, in comparison with those of Fredericton (164 feet above sea level) and Chatham (21 feet) here follow. The localities average about ten miles north of Chatham and eighty miles north of Fredericton.

Date.	Place.	Elevation	Min. Temp.	Min. Fred.	Min. Chat.
July 11-12	100 feet over Hough Lake.....	1650	46	52.2	54
12-13	" " " " "	1650	63	61.4	50.5
13-14	Skunk Lake.....	1648	66	66.4	64.5
14-15	Above Forks, North Pole Branch.. ...	1200	59	60.9	65.5
15-16	Below Forks, North Pole Branch.....	1175	34	49.4	62.
16-17	Big Bend, North Pole Branch.....	1127	39	51 9	50.
17-18	Three miles up North Polo Branch....	1025	57	53.2	48.
18-19	Below Forks, Lower North Branch....	1070	40	62.1	58 5
19-20	Plateau slope near Kagoot Mt.....	2000	53	59.9	57.
20-21	Valley between Kagoot and Caribou ..	1700	28	48.9	60
21-22	Source South Branch Sevogle..... ..	1552	38	50.9	50.
22-23	Forks Clearwater-Sevogle.....	717	38	46.0	47.
	Average	1376	46.7	55.2	55.5

This table shows that while at times the minimum temperature is higher in the Central Highlands than at Fredericton or Chatham, it averages some nine degrees lower, and at times runs very much lower. The most conspicuous case of this is in the temperature 28° on the night of July 20-21. That this is no error of record or instrument is shown by the fact that in the morning we found outside our tent a cake of ice in the bottom of a cup, which was itself frozen to the moss on which it rested. I have noted another striking example of summer frosts in this region. On the sources of the Northwest Miramichi on August 27-28, 28-29, 29-30, 1903, the frosts were so heavy as to whiten all the vegetation around and freeze the water in our pails. Mr. M. I. Furbish has also sent me a note to the effect that once on August 13th at the Waagan water froze in a pail beside his camp to such a thickness that the pail could be lifted by the dipper frozen in it; and it is said there is frost there every month of the year, a

matter of some interest in connection with the agricultural future of that region. Again Mr. Edward Jack records snow on September 30 on the headwaters of the Little Southwest Miramichi (Acadiensis, V. 137).

Another weather phase of some interest, on which, however, I have only impressions and no figures, is the frequency of showers in the Highlands. During several trips I have experienced heavy showers, often to an annoying extent, and they seemed to me much more frequent than I had ever observed elsewhere in the Province. I think it very probable that the Central region is elevated enough to produce rain from clouds which would pass over the lower parts of the Province without precipitation. If this is true, it would not be the forested condition of the country alone which keeps up the summer level of the streams in the Central Highlands, but the larger water-supply as well.

97. On the Physical Geography of Miscou.

Read in abstract, Dec. 5, 1905.

The northeasterly part of New Brunswick extends a long angle out into the sea, and, undulating down beneath its surface, ends in a line of peninsulas and islands of which the ultimate is Miscou. An island curiously formed and forever in change, haunt of wild life and center of quiet scenic charm, storied of old, remote from progress, primitive in population, it appeals to our interest in many a different way. But we are concerned now with the method of its origin and the curious facts of its physical geography.

We note first the development of our knowledge of its scientific phenomena, and begin with its geography. Having been the center of a valuable fishery from the earliest advent of Europeans, possessing a very good harbor, and being readily accessible from the sea, it was early mapped by French missionaries and geographers, notably by Denys, 1672, Jumeau, 1685, Franquelin-deMeulles, 1686, an unknown surveyor of 1755, and others, followed more or less accurately by the general maps of

the time. But these maps were merely sketches, often extremely crude, and it was not until the surveys of DesBarres for his famous "Atlantic Neptune" about 1770, that an approximately correct outline appears. The first survey for cadastral purposes was made for the Crown Land Office in 1820 by Deputy Surveyor West, whose large-scale map, corrected and extended by many land-surveys since made, is the basis for all of our present maps, excepting only the Admiralty charts. A new Admiralty survey was made in 1838 on which are based all the modern charts. But no published map down to the present, aside from the very small-scale and generalized surface geology map, and no plan or map in the Crown Land Office, has attempted to show the curious physical features of the island.

Such a map, however, has been made by Dr. J. Orne Green of Boston, who has visited the Island for many years past for sport and health and who has made some study of its geography and natural history. This map, by his kind permission, I have used along with other data,* in compiling the map accompanying this paper.

Of scientific study the island has had very little. Some general references to its characteristics occur in local books, but the

* In compiling the accompanying map, I have used the plans in the Crown Land Office, the Admiralty charts, (especially the large-scale chart showing Miscou Harbor and surroundings), Dr. Green's map, sketches of my own, (notably in the outlines of the upland), and traverse surveys made by myself of the outline of Grande Plaine, and of Lake Chenire and Big Lake. During my three-weeks visit to the Island in August-September, 1905, I was able to examine every part of the shore except the part between Birch Point and the Mal Baie North Gully, and all of the important parts of the interior of the Island except the eastern edge of the principal upland tract—that from Lake Chenire south to Miscou Harbor, which part may be somewhat inaccurate. The geography of the remainder of the island is of course only approximately correct, and owing to the failure of the accessible data to accord with one another I have had to compromise and "fudge" somewhat. This is notably the case in the vicinity of Cowans Lake and its relations with the Queue of Big Lake. Further I suspect the Crown Land plans I follow for Mal Baie South are in error, and it should be made considerably larger. In order not to interfere with the clearness of the map for physiographic purposes I have omitted most of the names of the less important lakes and other places, as well as all data and names connected with settlement. These are, however, given in full on another map of the same scale accompanying my "Founding of Miscou" mentioned on the next page.

first student to visit it was Moses H. Perley who was there in 1849. He gives some account of its physical characteristics, together with much information about its fisheries and its history, in his well-known Report on the Fisheries of New Brunswick of 1850. Among his other observations he describes the finding of great quantities of walrus bones at Grande Plaine, and this is the original of the frequently (and sometimes incorrectly) quoted accounts of those interesting objects, which are more fully described in a later Note, (No. 98), of this series. No other student visited Miscou until 1886 when Dr. Robert Chalmers, accompanied by Dr. G. U. Hay spent some two weeks upon the island examining its surface geology and botany, with results mentioned in brief in Dr. Chalmers' Report on the Surface Geology of Northeastern New Brunswick of 1888 and shown on his surface geology map accompanying the report. Aside from these I can discover no further mention of the island in all our scientific literature. Dr. J. Orne Green during his many long visits to the island has made observations upon its natural history, especially its bird life, but unfortunately the results have not been published.* Finally, I spent three days on the island in 1904, and three weeks in 1905, making the observations which follow.

Miscou is a famous center for a special kind of sport, the shooting of wildfowl, which resort in immense numbers to its lagoons and lakes; and many sportsmen have visited it for that purpose. But I have not noted any references to it in any of the sporting literature I am acquainted with.

Historically the island is of unusual interest, and much thereon has been published, all of which I have tried to summarize, with the addition of some new material, in an essay on "The Founding of Miscou" to appear with an historical map as part of a Monograph to be published soon in the Transactions of the Royal Society of Canada. The island has a population of some 500 to 600 English and French, mostly following the rich fishery

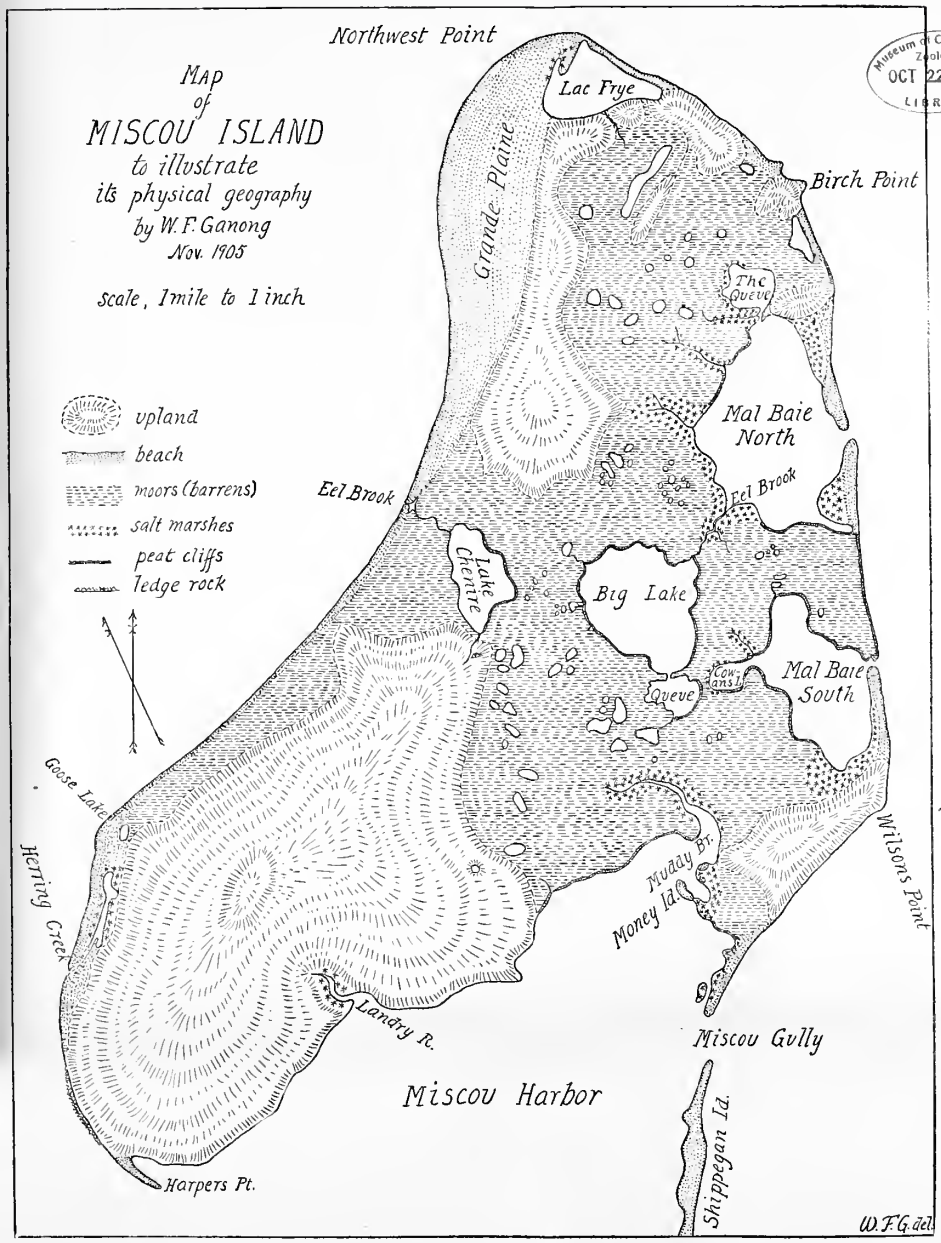
*As this paper is in press, I learn that Dr. Green has presented a paper before this Society upon the game birds of Miscou; and doubtless it will appear later in this, or in the next following, Bulletin.

of which the island is a center, and farming a little incidentally. They are a simple, healthy, and hospitable people..

Miscou owes its existence to the fact that this part of New Brunswick consists of a series of ancient, low northeast-southwest ridges and valleys, most elevated to the southwest and dipping under the sea to the northeast. The central one of these elevations (Note 93), probably the crest of an anticline, is the highest, and hence remains longest above the sea-surface, forming the long projection which makes the northeastern angle of the Province. Because of local irregularities this ridge shows as a series of islands just before it vanishes entirely, Miscou being the last of the series. Miscou itself indeed is not a single island but several, joined by bars and bogs. Miscou Harbour, deepening westward, originated no doubt as an ancient valley tributary to one of the great rivers which once flowed along our present Bay Chaleur.

Centering our attention now upon the island itself, we find that it consists essentially of three larger, with several outlying smaller tracts of wooded upland, swelling gently and irregularly above a shallow sea. These upland tracts enclose, roughly, a triangle, and, joined together by festooning bars and beaches which widen in places to plains, they encircle lagoons and lakes with moor and salt marsh. We therefore have to consider, the upland, the beaches and sand plains, the bog-barrens, and the salt marshes.

The outlines, positions, and mutual relations of the tracts of upland are well indicated by the accompanying map, on which their outlines, while mostly merely from sketches, are yet, I believe, approximately correct. The highest points of the respective tracts, which in no case exceed 30 or 35 feet above high-tide level, are approximately indicated on the map. Their surfaces are gently and smoothly undulating, and, except where cut into cliffs by the encroaching sea, dip imperceptibly under water, beach, marsh or barren. They were originally, and are still in part, wooded with a small-sized mixed forest. Doubtless each possesses a core of rock, but I was able to find it in only two places, both on the larger southwestern tract. The most im-



portant of these is the exposure of much jointed and irregularly bedded soft gray sandstones which form the beach and low vertical wave-cut banks at the southwestern angle of the island, the only place on Miscou, according to the residents, where ledge rock shows on the coast. The second place is beside the new highway road a little south of Lake Chenire, where, in a pit dug to obtain material for a new road, the same sandstones appear.* I am told also that ledge rock has been struck in a well near Wilson's Point, and that it occurs on the beach in the harbor. Elsewhere, where the sea is cutting into the upland, as just west of Lac Frye, at Wilsons Point, at Miscou Harbour, at Money Island, south of Eel Brook, along the old bank-line at Grande Plaine, it is working against typical, compact, rather fine-grained glacial drift, which evidently forms much of the surface of the island, affording a soil of fair quality farmed by the residents.

We turn next to the beaches. The shallow sea about the island has, according to the charts and the sailing directions, a bottom sometimes of rock, but usually of sand, while close to the shore it is almost everywhere of sand. Further, excepting for the rocky shores at the southwest part of the island, the stony (small sandstone cobble) reefs off Birch and Wilsons Points, and occasional peat banks at points to be noted below, the beaches between tides are also of sand, gently shelving and compact, affording the finest possible beaches for travel, and, perhaps, for recreation in the future. And in most places the sand is driven by the waves still higher, until, intermingled with driftwood, gravel, cobbles and occasional boulders brought from Gaspe by the ice, it is piled in ridges above high-tide mark. Here the wind drives the drying sand still higher, forming low dunes, up to six or eight feet high, which become sparsely clothed with beach grasses. Such beaches are formed only on flatly shelving shores, never against abrupt upland; hence on irregular shallow coasts

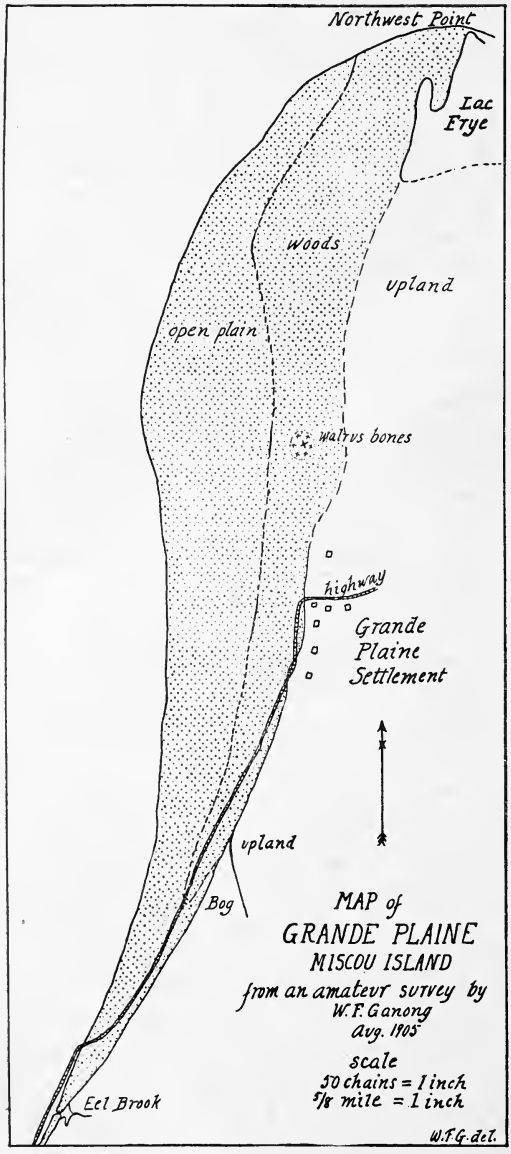
*The "Sailing Directions" speaks of a steep sandstone cliff at Birch Point ten feet in height. Yet as I have myself observed there is no rock visible here upon the shore or elsewhere, and the residents say none is known to them. I think the compact glacial drift forming the bank has been mistaken for a sandstone ledge.

they tend to grow between headlands, which act as anchorages for them, and between which they are beaten in by winds and waves to graceful inbowed curves, often enclosing salt lakes or lagoons. Such a barrier beach, now, however, much modified by changes later to be described, extends from the rocky upland at the southwestern angle of the island northward in a gentle curve to the Goose Lake point, enclosing Herring Creek and Goose Lake. At the Goose Lake point, there is now no upland, but the character of the place, on which stands the Lighthouse, suggests that it possesses a core of upland recently above the sea. From this point another beach runs in a curve to the upland North of Lake Chenire, enclosing between it and the upland a line of low boggy swamps or meadows which were, as recently as 1838, salt ponds or lagoons as shown in the Admiralty charts made in that year. North of Eel Brook, owing to local causes discussed below, the single dune beach gradually broadens into the remarkable great sandy plain called Grande Plaine. From the northern extremity of Grande Plaine the beach extends in a gentle curve to the upland at the eastward, enclosing Lac Frye, while to the southeastward smaller beaches between neighboring tracts of upland enclose two smaller lakes. Then it continues south, with an open gully, to a peaty headland enclosing the salt lagoon, Mal Baie North, and from the peaty headland south to Wilsons Point enclosing, (with a break of the gully), Mal Baie South. A striking fact about the beaches between Birch Point and Wilsons Point, however, is that they have not the usual concave form from headland to headland. The explanation is plain enough. The headland between the two Mal Baies is not of upland but of peat, which is rapidly being eroded away by the sea, and the base of the beach north of it is following it inward, destroying the proper curve. From the upland of Wilsons Point to that near Pigeon Hill, Shippegan, a very typical barrier beach runs in a characteristic great curve, cut by a typical gully, making Miscou Harbor, in its western part at least, practically a lagoon. And beyond Shippegan a very typical series of these great beaches may be traced along the coast, hanging in graceful festoons from headland to headland, all the way to Buctouche.

Thus we see that Miscou Island, while given its general form and size by the remnants of upland not yet sunken beneath the sea, has most of the details of its form, especially its system of graceful inward curves, given it by the barrier beaches festooned from upland to upland.

Such is the present position of the beaches. They are, however, by no means fixed, but among the most highly plastic and unstable of geographical features. Aside from the swinging of their basal ends with the inward moving upland, they show, in Miscou at least, two other marked movements. The first is in the position of those breaches or gullys which, ever tending to be closed by the waves, are ever made anew by the pressure of the accumulated waters inside. The older maps of Miscou all show the gullys of Lac Frye, the two Mal Baies, and Miscou Gully itself, in different positions at different times, and such changes show their traces on the outlines of the beaches themselves. Again, at two points on the shore outside the dune beaches (namely just south of Eel Brook on the west coast, and north of Birch Point on the northeast coast) I found beds of peat, showing that the beaches are moving inward as the island sinks, a point further to be discussed below.

We turn next to that very striking and remarkably interesting modification of the dune beach, the great beach-plain called Grande Plaine. Its general position, form and relations to the neighboring uplands are well shown, in large part from actual survey, on the accompanying map. It is in effect a multiplication of the usually single dune-beach up to some thirty or more parallel beaches, the whole resembling with their crests and hollows a gently-swelling sea suddenly changed to sand. Towards the sea, and for part of its breadth, it is open and treeless, clothed only by the waving beach grass and a few low growths nestling in its shelter; but the other half on the land side bears a low mixed forest, which has obviously advanced on the plain from the neighboring upland. From the mature forest to the open grass of the beach there is a definite step, the transition being marked by very pleasing close-turfed swales with park-like avenues and clumps of scattered trees. This nascent forest proved of such



ecological interest that I made a somewhat careful observational study of it, the results of which, with illustrative photographs, will later be published.* The plain really begins about a quarter of a mile southwest of Eel Brook, where the single dune-beach becomes gradually two by a process seemingly of forking but in reality the result of the gradual addition of an outer newer to an inner older beach. At Eel Brook a third appears and north of that other, all by a similar process of almost imperceptible addition of newer outer beaches, until at the widest part of the plain, there are considerably over thirty of them. The older of all the beaches is of course that which connects the Goose Lake

*Probably in the *Botanical Gazette* for July, 1906, which paper will contain another map of Grande Plaine, in some respects more detailed than that in this paper.

Point, (though it is actually now being washed away at some points south of Eel Brook), with the upland just north of Eel Brook, while the next oldest is that which skirts the edge of the upland, here forming a remarkably regular sea-cut, steep escarpment from one or two up to fifteen feet in height. North of the widest part of the plain, the beaches, hitherto following the curve of the present shore line, swing to the northeast, form the western margin of Lac Frye, and continue straight into the sea, which is cutting directly across their ends. Here the evidence of the sinking of the island is very plain, for not only are the ends of the beaches being cut into those abrupt cliffs characteristic of a sinking shore, but driftwood is actually driven into the hollows between them. Better still is the testimony of the woods, which here continue directly to the margin of the sea which is washing them steadily away, while the peaty woods-carpet is exposed on the beach below high-tide mark.

Such is the general appearance of Grande Plaine. Examining it more narrowly, we find that it is by no means homogeneous throughout its extent. Thus, the dune beaches are by no means of equal breadth, height or distance apart. Because of various irregularities they show, it is by no means easy to measure exactly either their distances apart or their heights. The following figures express approximately the distance in paces from crest to crest of the beaches in a section from the sea to the upland at the widest part of the plain;—24, 17, 18, 17, 44, 26, 25, 12, 25, 32, 42, 96, 45, 20, 47, 68, (edge of woods), 15, 23, 18, 17, 15, 14, 11, 15, 14, 35, 31, and a few others not measured. In general the older inner beaches are both nearer together and more regular in size and height than those farther out. The irregularities in height are marked, some of the crests rising five, or perhaps, six feet above the intervening hollows, others only a foot or two. Furthermore the height-fluctuations are by no means uniformly distributed. Thus two of the beaches, which are also the widest, those marked 44 and 96 above, are markedly higher than others, and these higher ones can be traced for a long distance along the plain. Variations of another kind are shown in the remarkable swales, characterized by peculiarities of vegetation which I shall

discuss in my paper on that subject, and in the low places where standing pools of water occur. Furthermore, the vegetation itself expresses a marked break in the continuity of the plain-building, for there is an abrupt break between the older and larger trees on the inner narrower beaches, and the much younger trees on the swales and outer beaches. All these fluctuations show that the growth of the plain has not proceeded uniformly; and it is probable that a more careful study than I was able to give the subject would throw some light upon variations in the action of geological agencies in recent times.

In viewing the successive beach lines, the question naturally arises as to whether the inner are at a higher or a lower level than the outer. It is impossible without accurate leveling to tell this from a study of the plain at its widest part, but reliable testimony is available elsewhere. Just north of Eel Brook the entire breadth of the plain can be seen at a glance, and there is no question as to the levels; the inner beaches are much lower than the outer, to such an extent that the entire plain has a marked slope inward. Again, at the northern end of the plain, where the sea is cutting it directly across, the height of the outer beaches may be seen to be considerably greater than that of the inner, on which the forest now being washed away by the sea is hardly above the highest tide level. Further, the fact that the inner margin of the plain near the upland is in places little more than an alder swamp, points to the same conclusion. I have no doubt that as a whole the inner beaches average throughout of lesser elevation that the outer, precisely as we would expect on a sinking coast.

We consider now the mode of origin of Grande Plaine, involving the explanation of the anomaly of extensive land-building upon a sinking coast. There can be no question that the growth of this plain, from the very sharply-marked bank-line of the upland out to its present position, has been very recent, and also that it is still in active progress. The residents maintain that the plain has grown from about the margin of the woods to its present margin within the memory of men now living. This must be a great exaggeration, but the occurrence of the walrus bones within the margin of the woods, with their evidence that

these animals were slaughtered by man, (Note 98) presumably upon or near the then beach, shows that there has been this much growth, (a quarter of a mile), within historic times. Several questions are involved in the problem of this growth. First, as to the source of the materials. This is principally sand derived from the rapidly wearing upland of the island and vicinity, supplemented by a great quantity of drift material, wood, eel grass, etc.* All of the residents agree that the cove opposite the plain is a sort of huge eddy in which the drift, worked along the coast by the westerly winds, meets a tidal current sweeping around the north end of the Island from the east and bringing its own contribution; the collective material is there driven by the prevailing westerly winds upon the beach. Certainly immense quantities of driftwood are beached here, enough to supply the residents of Grande Plaine with most of their firewood, and a vast quantity besides. Great masses of eel grass are also brought here after gales, and, becoming buried in sand, help the rapid growth of the shore of the island. Of course, in lesser degree, sand and gravel and other material are worked into this cove in the same manner. Second, we consider the causes which have determined the plain-building in this particular place. The sharpness of the bank-line of the upland, (so obviously an ancient sea-margin that even the residents speak of it as such), shows that comparatively recently the sea beat directly against the upland, and the change to beach-building was very abrupt. Although the plain is evidently rapidly growing about its middle and widest part, it is being washed away at its upper end, so that it is in part material from the upper end of the plain which is forming its middle portion. In fact all the phenomena seems to me to agree in showing that the plain formerly extended, no doubt accompanying a band of

*Although the upland of the island is being everywhere washed away by the sea, in two other places a certain amount of beach building is in progress, namely at Birch and at Wilson's Points. The residents, however, agree that this active beach-building has been in progress only about two years, prior to which both places were rapidly washing away. The building of these places, if not indeed of Grande Plaine itself, must resemble that of the "forelands" of Nantucket, Mass., as recently described by F. P. Gulliver, (Report of the eighth International Geographic Congress, Washington, 1905, page 146).

glacial upland, much farther northward, its position being indicated by the shoals marked on the charts and described in the "Sailing Directions." At that time the eddy would also have been farther north. It was the sinking of the island which permitted the sea to cut off its northern end and roll it, so to speak, with the eddy, down the coast, a process still in progress.* And it will no doubt continue until all of the plain north of the upland, with Lac Frye (once, apparently, a lagoon like Mal Baie and perhaps earlier a fresh-water lake) will have vanished, and a much broader plain will have grown gradually southward, filling the cove north of Eel Brook. Finally we consider the exact details of the mode of building of the successive beach lines, which, clear enough in the cases of the single barrier beaches, is not so obvious where these form a multiple series. In this beach-building, I believe, the presence of the drift wood, eel-grass, etc., plays an important part. All stages of the process may now be seen in operation. The sea at ordinary tides throws the drift wood (largely great trees and cut stumps washed out of rivers by the freshets, with refuse from the mills, etc.) on the beach and the highest tides push it yet higher, until finally some combination of great tide and strong storm pushes it entirely beyond reach of the waves. Then the dried sand, driven landward by the winds, collects among the wood, and gradually buries it in a low dune beach. Meantime the beach grass, succeeding the first beach plants, takes possession and gradually binds the sand so that it no longer moves with the wind. At the same time the beach is growing outward, more drift wood is accumulating, presently a new dune-core is formed, and so on in successive lines. That the drift wood does thus form a core in the beach is shown by the pieces projecting from the various outer beaches, though from the inner this has all vanished by decay. It may be that the

*The abrupt transition between the forested inner beaches and the swales and outer beaches, a transition shown not only by a difference in age of the trees but also by the step from narrow sandy beaches to broad swales, indicates, I believe, an interval between the building of the original Grande Plaine, and the addition of the new beaches from material rolled down the coast. I have, perhaps, made this point clear in my paper (above cited) on the vegetation of Grande Plaine.

need for some combination of great storm and tide to place the core of drift wood above reach, of all ordinary tides explains the fluctuations in the breadth and elevation of the beach lines; the greater may represent the result of some unusual combination of these influences. Further it may be that fluctuations in the supply of the drift wood will explain the variations in the regularity of the beaches. Thus it may be that the lesser size and greater regularity of the inner beaches may be correlated with the fact that they were formed prior to the days of lumbering when the supply of drift materials would be both smaller and more regular than since the settlement of the country. Further, causes of minor irregularities in the outer beaches are found in the operations of the residents nearby whose cattle destroy the beach grass allowing the dunes to blow to pieces, and whose wood-gathering teams cut the beaches in various ways.

So much for an outline of the formation of this interesting place. My study of it was very general, and much remains still to be made out. It will repay a far more detailed study than I was able to give it.

A plain-building on another principle is in progress now south of Goose Light. Formerly this coast was fringed by a single beach inside of which was a line of ponds, surrounded by bog and marsh, including several ponds shown on the Admiralty chart of 1838 but now replaced by bog or marsh. In recent times, as a result, I am told, of the destruction of the beach grass by cattle, this outer beach is being blown by the wind on and across the old marsh and bog, covering it with a sand plain and forming new beach lines against the upland. In this way Herring Creek and Goose Lake have been greatly lessened in size and are now threatened with total extinction. At first I thought that Grande Plaine itself had been formed in this way,—by the advance of the beaches over a flat country carried by the sinking of the land under the sea; but further study has convinced me of the correctness of the explanation above given. Near Herring Creek, both on the north and south of its former outlet, occur the highest and most typical sand dunes I have found in New Brunswick.

They are some 20 or 25 feet high, of pure rolling sand, and are overwhelming the old forests formerly standing there.

We turn now to the consideration of the great moors or bogs, or, as the residents call them, barrens. They cover well-nigh half of the area of the island, filling in the space enclosed by the tracts of upland, and lie to some extent beneath the beaches outside them. They are as typical and finely developed raised bogs or Hochmoore as it would be possible to find, resembling physically and ecologically those I have described from Charlotte County.* Because of their greater extent they show more fully the hochmoor characters than do the Charlotte moors. Every gradation in structure is presented, from the typical flat bog (Flachmoor), heavily wooded and verging to swamp, on the western side of the island (especially in the angles both north and south of Eel Brook), up to the raised, treeless, pond-dotted Hochmoors of the central and eastern parts. Here they form low elevations, rounded hills or ridges with intervening hollows and valleys, the whole simulating curiously, especially when tiny rills or deadwater streams occupy the valleys, the topography of a country of ripe and low relief. At the highest parts the mosses seem dead, but about the ponds they are still in growth. The basis of the moor is of course sundry species of sphagnum, forming typical rounded hummocks and polsters, on which grow the dwarfed Myrica, Ledum, Vaccinium, Rhodora, Kalmia glauca and other heaths with the various associates usual upon New Brunswick raised bogs. Scattered about are the little islands of dwarfed spruce and the many ponds and lakes. These ponds are of all sizes from little pools that one can almost leap across up to the large Lake Chenire and Big Lake, lakes of apparent considerable depth, the latter nearly three miles in circumference. They stand also at all levels, from those near the highest part of the bog, down to Big Lake and Lake Chenire, not much above the level of the sea; and it often happens, as on other moors, that two lakes but a few yards apart differ several feet in level. All these characteristics however are common to all hochmoors and need no special description here. There is however a striking peculiarity of Big

*In Transactions Royal Society Canada. III., 1897.

Lake, true also to a lesser extent of Lake Chenire, namely, its banks are formed of vertical walls of peat, some six to eight or more feet above the water, which are being cut away by the lake itself.* They thus resemble exactly the peat-cliffs bordering the sea to the eastward. Here, at places shown on the map on the two Mal Baies, on Miscou Harbor along Muddy Brook, and on the open sea between the Mal Baies, the moors are being eaten into by the sea, the peat forming vertical cliffs from one or two up to eight feet in height. This is particularly striking on the coast between the Mal Baies, where the sea is rapidly cutting into the low peat cliffs, carving them precisely as it carves a soft-rocked coast. I suppose there is no doubt that the two Mal Baies were recently fresh water lakes like Big Lake, and that the encroaching sea will presently eat its way along Eel Brook and cut into Big Lake converting it into a salt lagoon. The outlet of Big Lake now falls a foot or two over sand and gravel into the salt water.

But how did these moors originate, and what influences have given them their present form? It is, first of all, plain that they were formed when the island was much larger and much higher above the sea than now. Sphagnum moors can only form in fresh water, and they extend much beyond the present limits of the island, since they occur outside the dune beach on the west of the island south of Eel Brook, and again outside the dune-beach north of Birch Point. Further, they must have extended far off to the eastward to permit thick peat beds now to border the sea. Their formation implies the presence of a great shallow impervious basin with a complete rim of upland, a rim now sunk beneath the sea and represented in the extensive shoals on the west side of the island, and by the shoals and reefs off Birch Point and Wilsons Point (described on the Admiralty charts and "Sailing Directions") on the east. Probably the margin of this basin was formed by glacial upland, not by rock, which will explain perfectly its total disappearance. The sinking of the land

*Big Lake shows in one or two places sand beaches against the peat-cliffs. At first sight the peat seems to rest upon them, but examination shows that they rest against vertical walls of peat.

permitted the sea to enter the original basin and then to eat away the bog itself. The ocean has since gradually advanced, cutting away the peat, entering large freshwater lakes and converting them into saltwater lagoons, and throwing barrier beaches across their open sides. This process is still in progress and will no doubt continue until all the moors will be removed and the barrier beaches from east and west will meet in the line of the upland across where now lies Lake Chenire.

Salt marshes occur in the very sheltered places in the angles of the lagoons and along the quiet salt-water streams, as shown on the map. They are of considerable economic importance for their wild hay, but they have had little part in the building of the island. Small areas of freshwater meadow occur in places, as along Eel Brook below Lake Chenire and elsewhere; and there are some areas of true swamps, but these are not of sufficient size or definiteness, and especially are not well enough known to me, for representation upon the map.

Thus we see that physiographically Miscou is one of the most interesting of the parts of New Brunswick. It represents an area of unstable equilibrium, and owes its characters to delicate adjustments of level. Nowhere in the Province are topographical changes in more active progress or their operation so clear.

98. On Semi-Fossil Walrus Bones from Miscou and Elsewhere in New Brunswick.

Read December 5, 1905.

The evidence as to the former occurrence of the walrus, or sea-cow (*Trichechus rosmarus*) in New Brunswick is summarized in an earlier note (No. 80)* of this series. Since it was written I have been able to study the principal ancient resort of the walrus at Grande Plaine, Miscou, and to collect there the bones

*One historical reference to be added to those there given is found in a document of 1756 which states that the Acadian refugees at Miramichi at that time had to live in part upon sea-cow. (Raymond. *History of the Saint John River*, 121).

which have been placed in the Museum of this Society.* The bones occur at the locality marked on the smaller map accompanying the preceding Note (page 456), in which also is discussed the mode of formation of the remarkable beach-plain on which they are found. The place is now over a quarter of a mile from the sea, well within the margin of a sparse spruce wood, and covered by its mossy carpet. At the place of their greatest abundance they are scattered over an area of an acre or so, and are manifest to the eye either through the whiteness of an occasional exposed portion, or else by the mossy hummocks covering the skulls and larger bones. As a rule they are scattered or isolated, though at times small groups are found together in their natural relations, though no skeletons anywhere near complete can now be found. Most of the bones are much decayed, though the skulls and lower jaws, with femurs and a few others, have been fairly preserved through their great hardness. A noticeable fact about most of the skulls is that they show the large bullet holes into the brains by which obviously the animals were killed, while the marks of the axes by which the tusks were hewn out of the skulls are visible upon all of them. These signs confirm the testimony of both history and tradition which state that this was a famous hunting ground for these animals at the first settlement of the country. The bones lie partly imbedded in sand, a very poor material for their preservation, and so far are they decayed that it will be now only a few years before they will all have crumbled away; and then this last visible testimony of the former occurrence here of the walrus will have vanished forever. For some time to come, however, the visitor will be able to make a selection from the piles which I left beside the path, having collected them in the selection of those I brought away for the Society, and it is one of these piles which is shown on the accompanying photograph. Although this is the principal locality at

*These bones include a very large nearly complete skull, another cloven skull, two lower jaws, part of a tusk (found at Goose Lake, Miscou, and given me by the light keeper), two femurs, two vertebræ and a rib. These were selected as the best among a large number dug up and examined.

Grande Plaine, a few occur elsewhere,—on the edge of the woods to the southwest, as I have myself seen, and towards Northwest Point as reported by residents, though I was unable to find the latter locality. I have, however, under the guidance of Mr. Jas. Bruno, keeper of the Goose Light, seen a few walrus bones uncovered by the shifting of the beach south of that light.

So much for the Miscou localities. Although I have made many inquiries I have been able to learn of but a single other place of occurrence of walrus bones in all New Brunswick. The Museum of the Miramichi Natural History Association (see their Procedings, IV., 58) contains a walrus jaw presented by a resident of Burnt Church. I am informed, however, by Dr. Philip Cox that it was found on Portage Island, and also that he had searched there exhaustively for others but without avail. As the walrus no doubt formerly resorted all along this coast, and was probably hunted here as at Miscou, its bones must have formerly occurred here. But they have probably all been washed away by the sea, which is everywhere encroaching rapidly upon this coast. It is only the remarkable and unique conditions which prevail at Grande Plaine, Miscou, (where, owing to local causes, the land is being built out instead of removed), which have preserved the bones in that locality.

So far as I can learn, the bones now in the Society's collection are the only ones from Miscou in any museum. Dr. Chalmers collected a number some years ago for the Geological Survey of Canada, but I am informed they were not preserved and are not now in the Survey Museum. References to the bones at Grande Plaine occur in Perley's *Report on the Sea and River Fisheries of New Brunswick,* 1850, 33, in Ells' *Report on the Geology of Northern New Brunswick,* 1879-80, D, 43, and in Chalmer's *Report on the Surface Geology of Northeastern New Brunswick,* 1888, 27 N. A reference to their expected (but unrealized) occurrence in shell-heaps in the Bay of Fundy is in Boardman's *Naturalist of the Saint Croix,* (Bangor, Me., 1903), page 242.

Bones of Walrus, Grande Plaine, Miscou, photographed in September, 1904.

99. On the Physiographic Characteristics of the North Pole Branch of the Little Southwest Miramichi River.

Read in abstract January 2 1906.

The Little Southwest Miramichi, one of the largest, and certainly the most typical, of the wilderness rivers of New Brunswick, is formed by the confluence of five great branches. The two most important of these, the Tuadook and Walkemik Branches, are somewhat fully described and mapped in earlier Notes (Nos. 55, 86, 87), while a third, morphologically the main stream, has been also mapped in part (Note 87).* Last summer I was able to observe the larger part of a fourth of the great branches, the North Pole Branch, on which I wish here to offer some comments, illustrated by the accompanying map.† I also saw something of the fifth branch, the Lower North Branch, but must make another visit to it before attempting any description.‡

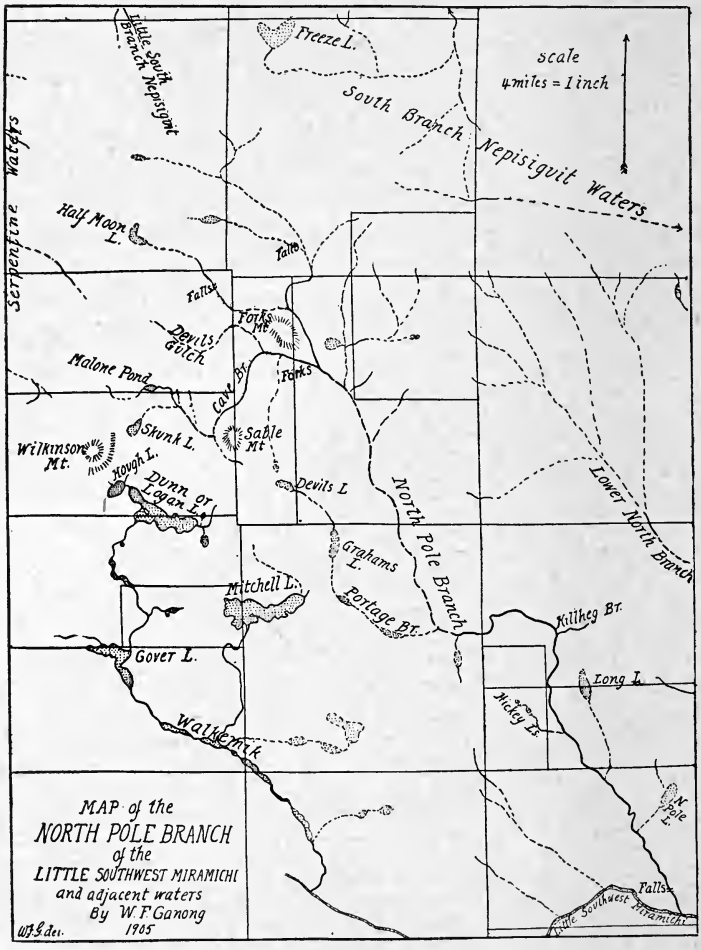
We note first the development of our knowledge of this little-known stream. Because of its remoteness from all settlement, especially at its source, which lies in the very heart of the central watershed in a wilderness still unbroken even by lumbermen and hunters, it has been rarely visited, not at all studied scientifically, and mapped very imperfectly. It makes a first, but naturally crude, appearance in records, however, as early as 1686, on the

*This summer I was able to see also its extreme source, in the two little plateau ponds beside the portage road between Portage and Gover Lakes.

†The map of this branch is compiled from the timber-line surveys in the Crown Land Office, from observations made by us, and from sketches supplied to me by Henry Braithwaite. I hope later to offer the Society a much larger scale and more accurate map of its head waters.

‡I was accompanied by my friend, Professor A. H. Pierce. We were taken by team to Gover Lake via Portage Lake (Tobique) over the portage road. From Gover Lake we went alone on foot, carrying provisions and outfit in packs, and making occasional side-excursions, to Hough Lake and Skunk Lake, Half Moon Lake, Malone Pond, down the outlet of the latter to Cave Brook and the North Pole Branch, down this to near its mouth, across by portage road to the Lower North Branch, up this to the source of the eastern branch, north over the watershed to South Branch Nepisiguit and Kagoot, and down the South Branch Sevogle to Miramichi.

remarkable Franquelin-deMeulles map where it bears the Micmac name of *Kednatteguec.** It makes a second appearance, without



*The North Pole Branch is called by the Micmacs to-day *Kay-dun-at-que-gak*, (meaning unknown), a word which might well be simplified for use to Kednegek (g hard and accent upon the last syllable). The name *North Pole* apparently first appears in documents upon Fish's plan of 1880 and Freeze's plans of 1881, and Mr. Freeze tells me that he found the name in use among lumbermen when he made his survey, and supposed it originated in the old pine-timber days from 1840-1860, when much pine lumbering was done on the river. It was very likely named because of its

name, as a crude sketch upon Baillie's maps of 1832, is shown at its mouth and named the "North Branch" on Berton's Survey map of 1838, and is sketched in its lower courses and wrongly called "Upper North Branch," on Wilkinson's map of 1859, undoubtedly from data supplied by lumbermen. The very first point located by survey upon its course was given by a timber-line survey by Deputy Surveyor Fish, which crossed it west of Long Lake in 1880 (See the accompanying map). The next year Deputy Surveyor Freeze surveyed its lower ten miles, the only part of its course yet surveyed, and in that and the following year ran the several important timber lines which gave us our first knowledge of a large section of this wilderness tract and located several additional points on its course and tributary streams. These were the data which Mr. Loggie had in making his map of 1885, and he was followed closely, though with some slight variations, upon the geological survey map of 1887, which represents the best map yet published of this stream. Since 1881 various additional lines have been run from time to time as the needs of lumbering demanded, giving additional locations for the courses of the various streams; but as no additional surveys whatever of the streams themselves have been made, these are necessarily, both on the Crown Land Office plans and on the accompanying map, simply sketched between the intersections of the timber-lines. On the map I have tried to show the less certain portions by the most broken lines.

So much for cartography, and there is little left to add. Of scientific study there has been none; no geologist has visited the stream, and there is no mention of it in any of the Geological

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great extension northward, supplemented perhaps by the coldness of its water. It is commonly shortened in use to "The Pole." Of the other names on the map, *Kill-Heg Brook* was given by Freeze, for a wooden kill-heg or killeck trap found by him there. *Skunk Lake, Half-moon Lake, Devils Lake, Graham Lake, Sable Mountain, Portage Brook, Devils Gulch;* were all given by Henry Braithwaite, presumably descriptive of form or use or other peculiarity. *Malone Pond* was given by us because touched by a timber line run in 1903 by W. Malone. *Cave Brook* was given in 1900 by W. B. Hoyt, descriptively, as he tells me of the physical characters of the stream. *Forks Mountain* is a descriptive name of the lumbermen. *Hickey Lakes* and *Long Lake* are on Fish's plan of 1880 and no doubt are descriptive and for some early lumberman.

Survey Reports or in any other scientific publications. Sportsmen have visited it but little until very recently, and I find but two references in sporting literature. Mr. Frederick Irland was on the North Pole Branch in the spring of 1901, hunting bears with Henry Braithwaite, and he has described his trip in a charmingly-written and beautifully-illustrated article in *Scribner's Magazine* for September, 1901. And there is a reference to Half-Moon Lake, with a crude sketch map showing it for the first time, in Mr. E. Hough's account of his winter trip in 1901 through this region from the Nepisiguit to the Little Southwest Miramichi in *Forest and Stream* for Nov. 1, 1902. Mr. Braithwaite has hunted here for many years and has hunting camps at two of three points, while other guides from the Lower Miramichi are gradually entering the valley and establishing camps. Much lumbering has been done on the stream, especially below the Forks, in connection with which a number of portage roads have been built; but there is still much unlumbered country near its source, between which and the Nepisiguit branches remains the only piece of absolutely virgin wilderness now to be found in New Brunswick.

As the map will show, the North Pole Branch has not a single source, but several, radiating fan-like from a junction south of Forks Mountain. Of these source streams I have seen four, which are as follows. The most northerly is that on which lies Half-Moon Lake, a pretty crescent-shaped little woods lake, 2059 feet above the sea,* surrounded by low plateau hills, showing it to lie in a valley cut a little below the plateau level. The character of the stream above and below it I do not know, except that Mr. Braithwaite tells me it has "granite ledges and falls, 150 feet" upon it as shown on the map. Almost directly south of it on Braithwaite's trail, but separated from it by a mile of two of elevated plateau in a clear-water brook, Devils Gulch, running southeast in a curious little irregular gulch or gorge The rock

*Determined by aneroid checked for weather from Fredericton and Chatham, as were all other elevations given in this paper. Since, however, in all cases I was able to obtain but a single good measurement, and since single measurements are liable to much error, too much confidence cannot be placed in them. The elevation of the plateau south of Half Moon Lake I made over 2,200 feet.

here is granite in great angular blocks piled up like masonry, and the little gorge appears to be not at all of erosion, but of rift, origin. The course of this stream on the map is also from Mr. Braithwaite's sketch. Skunk Lake, 1637 feet above sea level, is a shallow, largely bog-bordered lake lying in a valley formed between Wilkinson Mountain and the Wheeler Mountain mass or plateau east of it, the same in which Hough Lake also lies and which is followed by the trail between the two lakes. It empties northeastward, but I have not seen its outlet. The fourth stream is that near the head of which lies Malone Pond, a most charming and typical little woods lake, whose outlet we followed all the way to Cave Brook and the main North Pole Branch. It leaves Malone Pond as a small stream, soon swinging to the east and the south east, rapidly increasing by the accession of many spring rivulets, and begins at once to develop little gulches or gorges in the granite rocks similar to those already described for Devils Gulch. Continuing southeastward it receives the Skunk Lake branch, and, still rapidly enlarging, developes larger gorges with much fall, separated by quiet alder-bordered sand-bottomed still-waters, often showing, as do the gorges themselves, abundant new beaver works. The stream then swings to the east in the vicinity of a fine great rounded hardwood mountain, Sable Mountain, and then to the northeast, keeping its general character though ever enlarging. The aspect of all the gorges gives the impression not of water-eroded channels so much as rifts in the regularly-jointed and bedded granite. At one place, where Hoyt's timber-line crosses Cave Brook, the stream bed lies in the bottom of a little gorge with vertical granite walls fifteen or twenty feet high. One side of this gorge is angularly concave while the other is an island the angles of which appear to fit into the concave side, showing that here at least the valley is a rift, though the stream has worn also little caves into the joints of the granite thus giving this stream its name. Below, the valley gradually opens somewhat and the gulches become infrequent; the stream is gentler and comes to flow mostly in a winding alder-bordered course through sand-bottomed still-waters. As it swings to the east it receives the shallow clear swift-flowing Devils Gulch

Branch, below which it is a large canoeable smoothwater and stillwater sand-bottomed stream winding amid meadows and alder-intervales down to the Forks (1175 feet above the sea) southeast of Forks Mountain.

The other branch of the North Pole, the larger stream, I have not yet seen above the Forks. The courses of the streams in the map are in part from the timber-line maps and in part supplied by Mr. Braithwaite, who tells me there are granite gorges ledges and falls on the streams shown on the map. I am inclined to think the main stream above Forks Mountain is very sluggish, for a lumberman has told me there is a deadwater or narrow lake, four miles long, on the upper part of this stream.

What now is the origin of these source streams of the North Pole Branch? Turning to the map, three facts are at once apparent. First, to some extent the valleys show evidence of that northwest-southeast parallelism so characteristic of the valleys of this whole central region. Thus there is a line of streams from near Malone Pond southeast along Portage Brook, which, as shown in an earlier note (No 87), probably connected Dunn, or Logan, Lake with the North Pole Branch, while both the Half Moon Lake Branch and the main stream fall in with this direction. I have little doubt that these valley directions are actually relics of the original system. Second, there are at least two valleys, the Hough Lake--Skunk Lake Valley and the Cave Brook valley, having a direction at right angles to the original system. These are very likely homologous with the part of the Tuadook below Crooked Deadwater (Note 86), the origin of which I cannot explain. Third, taken collectively, the source streams now form a fan-radiating system collecting finally into one trunk, draining a great radiating basin or circque, very similar to that of the Walkemik Basin described in an earlier note (No. 87). As in the Walkemik Basin also, the erosion of so many streams appears to have greatly reduced the elevation of the parts of the plateau originally separating them, reducing them for the most part (though with an exception in the case of the great ridge-like Forks Mountain, which must be still of nearly the Plateau height), to low ridges and hills. That such

a basin actually exists north of Forks Mountain, can be seen from Braithwaite's trail north of Skunk Lake, where it skirts the slope of the plateau, and it is implied in a statement made to me by Deputy Surveyor Freeze in speaking of the high range of granite hills crossing the stream at Forks Mountain. Presumably the "Falls" on the map mark the approximate boundary between plateau and basin. The direction of the upper course of this branch would also suggest that there it may originally been emptied into the Lower North Branch, forming the morphological head of that river. But the causes which have thrown these streams thus together, and as well the details of the geography of the basin must await more thorough study than I was able to give it. It seems to me, however, possible that several of the smaller streams may have had their directions determined by the formation of rifts in the granite of the region.

We consider next the valley below the Forks. From above the Forks down to the big bend of the river, it is a smooth-flowing, clear stream of abundant water, winding over gravel and cobbles and with occasional little rapids formed by a few small boulders. All this part forms, in ease of water and charm of scenery, nearly as pleasing a canoe stream as any I know. In but one place did I observe any of the granite gulches so abundant on the upper waters, and that was at the place about east of Devils Lake where the stream, close against the western valley wall, flows through a typical rifted gulch, with low vertical granite walls on each side, but deep and smooth without a fall. The entire valley itself while deeply cut (some 400 feet) into the plateau is mature, wide, drift-bottomed, the river having always a wide stony flat, commonly of the Rhodora-Hypnum-Black Spruce type, on one side or the other. Seemingly the valley was formed by a stream very much larger than that now occupying it, and in any case it has all the characters of an ancient valley and it is no doubt one of the original Northumbrian System (Note 93).

Such is the stream down to the big bend ten miles from its mouth. From an inspection of the course of this curious bend, (1127 feet above sea-level) on the map, on which, since it is within the limits of Freeze's survey of 1881, it is accurately represented,

one would naturally infer that it is post-glacial, the original pre-glacial course cutting across the bend along the courses of the streams and lakes which occur there. And I ventured such a prediction in an earlier note in describing Mitchell Lake and surroundings (Note No. 87). But this supposition is wholly erroneous, for the river preserves its ripe, gentle smooth character all around the bend, and is evidently in an ancient and mature valley. Its abrupt bend to the north is simply a minor winding around drift hills in the wide valley. The origin of the great bend in the valley is of course a question of much interest. Turning to the map we note that it is directly in line with the valley of Portage Brook extending up towards Dunn Lake through the Mitchell Lake Basin (Note 87); furthermore, in continuation of its direction off to the southeastward I saw a marked high gap in the plateau and beyond this gap, in the same direction, there is, as shown on the map, a valley occupied by a brook (Whitney Brook). And I myself noted that where this brook enters the Lower North Branch that valley has a swing in the same direction. I have not traced it farther, but the direction continued eastward would carry it through Guagus to Mullins Stream Lake just below which comes one of those remarkable great bends which characterize all the valleys of this region (Note 93). We may therefore be dealing here with remnants of a very ancient valley parallel with the little Southwest Miramichi and the other rivers south of it, perhaps one of the original Northumbrian system.

But although the course of the river around the big bend is thus very ancient, it nevertheless seems plain that at some time its course was across the bend by way of the Hickey Lakes. Such a valley can be seen from the great burnt hills just above the bend, and seems consistent with the topography of the section as far as known.

Below the bend the character of the river changes for a time; here its course is obstructed with hugh granitic boulders making it very rough. This rapid water extends a short distance but occurs once more a mile or two lower down, where granite ledge rock forms the valley wall. Except for these two places the river seems to retain its gentle attractive character, winding in

great sand-bottomed smoothwaters, often with intervale banks, down as far as we saw it, three miles from its mouth. It is a great surprise to find so smooth a river in so rugged a region, and there is probably nowhere in the interior of New Brunswick so great an extent of good canoeing water, an evidence indeed of the ancient and ripe character of this valley. Just below the big bend, the valley widens into a basin bottomed by an elevated boulder-strewn burnt plain strongly resembling the Graham Plains and probably originating in a similar way. On its western margin runs the North Pole Branch in a deep trench cut into the rough materials of this plain, the boulders of which have here given it its rough bed, while on the eastern margin lies Long Lake, seemingly with a valley extending northward from it. This basin seems to have been a catch basin of the glacial period. Below, the valley narrows somewhat but always is mature and shows a rocky plain elevated well above the river bed. This plain, without doubt a continuation of that above the bend, and similar to those to be described on the Lower North Branch, represents the bed of the glacial rivers which poured their swift waters down these valleys during the melting of the glacial ice. It is into this glacial wider bed the present rivers have cut their narrow and newer channels.

We left this river about three miles from its mouth (finding it there of 1025 feet elevation) and did not see its lower course. But I had previously seen its mouth (Note 54) where it has falls. These are post-glacial, and the original junction with the Little Southwest probably lies a little to the eastward (Note No. 54) in a line with the course of the Little Southwest below it, which is really morphologically a part of the North Pole Branch.

100. The Recognition and Utilization of the Plateau Structure of Interior New Brunswick.

Read Jan. 2, 1906.

No doubt most people who know anything of interior and northern New Brunswick think of it as a hilly country only traversable along the valleys. Until recently this was evidently the idea of those whose business it was to lay out portage (lumber-

ing) roads and to explore routes for projected railroads; for all the old portage roads in the interior cling to the valleys as do the earlier routes surveyed for railroads.

In reality, however, all interior and northern New Brunswick is a plateau into which the rivers have deeply cut and it is only hilly where converging streams have carved the plateau to fragments, or where occasional masses of harder rocks have eroded somewhat more slowly than their surroundings.

This plateau structure is in recent years coming to be recognized in practice, for not only do all the newer portage roads in the interior mount from the valleys to the plateau, where they find a drier, more level, straighter and often shorter course from camp to camp, but it is, as I understand it, by the utilization of the plateau, making crossings of the valleys on high bridges in their narrowest parts, that the Grand Trunk Pacific surveyors have been able to locate a practicable, easy-grade route across the province.

NOTES OF CAMBRIAN FAUNAS.

Continued From Page 406.

curved; the valve also is more ventricose toward the ventral and the posterior sides.

These two fossils are of nearly the same size and a fuller collection of examples might show variations sufficient to unite them under one species.

The Ostracoda referred to at page 454 of the above named article as *Aparchites conchiformis* is identical with *Bradorona* (?) *robusta.*

This species is of larger size than those referred to the genus Indiana, and the valves are more angular in outline, showing a more decided hinge line and a somewhat triangular outline.

Indiana (?) secunda. — This species recorded from the upper part of Assise 3 of Band *b* (Protolenus Zone) under the name *Aparchites secunda,* has been found also in the lower part of that assise and in the Cambrian sandstone of Band *b* on Long Island in Kennebecasis Bay. The species approaches a Bradorona in form, but is proportionately longer, and although the outline is too strongly angulated at the end of the cardinal line to be a typical Indiana, we have thought it better to place it here than in Bradorona. It is intermediated in form between *Indiana lippa* and *Bradorna observator,* mut. *ligata.*

10. Trilobita.

A further study of material of the Protolenus Zone enables me to add something to what is known of the species of Protolenus.

Protolenus paradoxoides. — There are two varieties (perhaps sexual) of this species, the type (described in Trans. Roy. Soc. Can.) with flat narrow cheek, long glabella and narrow interior margin is the narrow form. The sculpture consists of numerous scattered tubercles. The other with tumid fixed cheek and broad interior margin, has a shell densely beset with small tubercles.

This species is distinguished from *P. elegans* by the irregular form and relief of the posterior glabellar furrow and the occipital furrow, such as may be seen in some Olenidæ of the Olenus Zone.

There is a tubercle at the inner end of each posterior glabellar furrow and a corresponding pair at the front edge of the occipital furrow; these paired tubercles sometimes show on three consecutive somites, viz., at the inner ends of the two posterior pairs of glabellar furrows and at the occipital ring. In this view it would appear that *P. bi-tuberculatus* should be regarded as a variety of this species in which the paired tubercles of the posterior somite of the glabellar are unusually prominent.

Protolenus elegans, W D. M. — This species is more abundant than *P. paradoxoides* but is of a smaller size. Its surface is minutely tuberculate or granular, or when worn appears punctate. The cheeks are always tumid and the front margin depressed. The occipital furrow is cut straightly and evenly across, and the paired tubercles seen on the posterior somites of the headshield in *P. tuberculatus,* are scarcely ever, and but faintly seen on the heads of this species.

The sculpture is always granular, and the occipital ring directly and smoothly transverse.

Collections made from the Paradoxides lamellatus subzone (C.l. c^1.) gives a lower range for some species common in the overlying subzone.

Paradoxoides Acadicus. — Two example of this rare species were found in C.l. *c.l.* it is distinguished by the deep, all-across first and second furrows of the glabella.

Sculpture.—The inner surface of the glabella is nearly smooth; the outer surface with a strong lens appears minutely granular, but in exact focus the sculpture is resolved into very fine concentric ridges which are crossed by oblique furrows, giving a granular appearance to the surface. The test is thicker than that of *P. Eteminicus* or *P. Micmac*. The sculpture of concentric ridges is faintly discernable on a test whose middle piece is 9 mm. long.

Paradoxides Regina. — An example of a broad flat pleura seem to agree best with this large species. It has the

strong traverse anastomosing ridges on the underside that characterize the species.

Solenopleura Ribbii var. — A middle-piece of a small Solenopleura occurs. It agrees nearly with *S. Robbii* except that the glabella and cheeks are covered with distantly placed tubercles; there are about twenty on the glabella and half that number on the fixed cheek behind the ocular fillet, and there are a few in front of the fillet.

Conocoryphe Baileyi. — One head of this species. found. The surface is minutely granulate. The common species of Conocoryphe of this horizon is *C. Walcotti.*

Worm and Gasteropod.

Orthotheca Micmac — One example was found with the usual distinct longitudinal striæ.

Capulus sp. — A minnte capuloid shell, smooth, with faint striæ of growth was found—it is on its side and flattened Height 4 mm., width 3 1-2 mm.

No. 11—Cambrian Fauna of Anse au Loup, Labrador.

Some years ago Dr. J. F. Whiteaves sent to the writer a fragment of the fossiliferous limestone of the well-known locality, of Anse au Loup on the Canadian coast of Labrador, where many years ago (1860) Jas. Richardson collected the species of brachiopods, trilobites, tubeworms, etc., which Mr. E. Billings described, and referred to the "Lower Potsdam" horizon.

In these limestones which are 141 feet thick and rest upon sandstones 231 feet thick the following species were found:—

Palæophycus incipiens.	Olenellus Thompsoni.
Archæoscyathus Atlanticus.	Conocephalites miser.
A.—— profundus.	Bathyurus parvulus.
Obolus Labradoricus.	B.—— senectus.
Obolella chromatica.	Salterella rugosa.
O.——? cingulata.	S.—— pulchella.
Olenellus Vermontana.	S.—— obtusa.

Also an Orthis and an Orthisina.

The piece of limestone sent contained abundant remains of the Salterellas with parts of trilobites including those of Olenellus Thompsoni.

The aspect of the surface of layers of this rock is well shown in the wood cut, Fig. 22, page 17, of the first volume of Billing's Palæozoic Fossils representing *Salterella rugosa,* Bill.

Mr. Billings does not mention that these fossils are preserved in phosphate of lime, which however is the case. As a result of the wasting of the limestone from exposure to the weather these fossils stand out prominently from the surface and are readily examined.

On examining these "Salterellas" carefully it was observed that there was no uniformity in the position of the tube within tube that Billings had observed for they were sometimes on one side of the outer tube and sometimes on the other. It is true that in the majority of cases the ensheathed tubes were similar, but in one a young *S. obtusa* was found in one of the rounder tubes referred *S. rugosa,* and one was led to surmise that the supposed sheaths were really independent individuals that had slipped, one within the other and so given rise to the appearance of a tube consisting of sheaths.

A similar condition exists in the tubes of *Hyolithes excellens* Billings found in the upper limestone at Smith Sound, Newfoundland, and of about the same geological age; there this condition of tube within tube is quite common, and the writer has suggested that the younger shell had a habit of taking possession of a dead shell, for the purpose of a firm support on the sea bottom. Whatever the cause, this phenomenon is exaggerated in *"Salterella" rugosa,* which is more frequently ensheathed that *H. excellens* and often shows four tubes, one within the other.

When we come to consider these tubes separately we find that we are dealing with a form which does not differ in any respect from *S. pulchella,* Billings. One should not overlook Mr. Billing's remark (page 18) that this species and *S. rugosa* are not in the same bed, and that the two species are not found together in the same fragments of rock. But while the en-

sheathed tubes do occur quite abundantly on one layer and are not obvious on another closely above or below instances of ensheathing can be found in layers where the single tubes of *S. pulchella* abound.

Mr. Walcott in his studies on the Cambrian Faunas of North America—Bull. 30 U. S. Geological Survey, Plate XIII, fig. 2, shows a good example of this ensheathing of *S. rugosa,* showing apparently no less than ten tubes one with another. This is an unusual number, and can hardly be attributed to accidental conditions; the specimen is from Anse au Loup.

If I am right in my explanation of the cause of the annulations in *S. rugosa,* it will be necessary to retire this name or that of *S. pulchella.* In Billing's publication of the two species *S. rugosa* stands first, but as the name in my view is based on a misapprehension of the characters, and is erroneous in its meaning, it would seem that *pulchella* should be adopted.

But in fact the whole genus *Salterella* of Billings is based on an erroneous view that these shells were species with strong annulations like Serpulites. "*Salterella*" *pulchella* is really a smooth shell, and a strong glass is required to make visible the very fine concentric striæ which encircle the shell.

These regular concentric striæ, the round tube a little flattened on one side and the slightly bell shaped aperture show that in *pulchella* we are dealing with a species of Orthotheca. Numerous examples show that the species was camerated at the proximal end by several diaphragms, convex downward. In no instance have we found an acute point to the shell which is always decollated. If a slender proximal end of rigid substance existed it must have been fragile, and broke away when exposed to abrasion in agitated waters. As Billings remarked, the tube had a slight curve. This was towards the ventral side.

Mr. Walcott has already removed the remaining species of Salterella, *S. obusa,* to the genus Hyolithes. As Salter had already named a *Theca* (=Hyolithes) *obtusa,* Billings name became a synonym. Walcott therefore gave a new name to the species, calling it *Hyolithes Billingsi.* This species, or one closely related is found with the Protolenus Fauna in Southern New Brunswick.

An interesting discovery in this fragment of limestone from Anse au Loup was that of remains of Foraminifera. The porous surface of the shells is not so well seen as in the specimens from the Protolenus Zone in New Brunswick, but the forms are quite similar. *Orbulina* cf.. *universa* is the most common, but other species of Orbulina, of larger size are present. Other species have more than one chamber and so fall into Globigerina, and are similar in form and size to those in New Brunswick; one shows two chambers, arranged like those of *G. turrita.* In a number of the globular forms a depression is found on one side, perhaps marking the orifice of the shell.

The shells of these Foraminifera are in most cases injected with phosphate of lime, which has preserved their form, and by its dark color in contrast to the lighter limestone, causes them to stand out on the surface of the layers like minute black seed.

The shells of the Foraminifera, though generally promiscuously scattered, in some cases seem to be aggregated near the Hyolithoid shells which also are filled with phosphate of lime.

ARTICLE VI.

OBSERVATIONS OF WEATHER AND PLANTS, 1905.

By G. U. Hay.

April 1.—A winter of great snowstorms, with very little rain and continued clear frosty weather which lasted up to about March 20. The roads at times were almost impassable, especially in the country near the coast. The branch railway lines in New Brunswick and Nova Scotia were nearly all closed throughout February and the greater part of March, and the trunk lines were kept open with great difficulty and delays to travellers. From the first to the 20th March the weather was clear and cold, thawing in the middle of the day but freezing hard at night. During the last ten days of March the temperature was milder, the heat of the sun causing a rapid disappearance of the not very solid masses of snow, and averting the threatened disaster of a spring flood, which heavy rains would certainly have caused. The average temperature for the month was 20.3° F. A flock of wild geese passed over the city March 26.

Wild Garden, Ingleside.

April 14.— Alder catkins discharging pollen when slightly shaken. The first fortnight of April has been chilly and damp, in contrast with the clear bright days of March. The earth is bare and brown without any trace of green, and snow lingers in the woods and sheltered places. The welcome notes of the early songbirds are heard morning and evening.

April 22.—The week has been cold with hard frosts at night, and high winds from south and south-west. Slight snow falls on the 17th and 22nd, but the snow quickly disappeared.

First ploughing on the 27th. North-west winds and sunshine alternating during the last week of April with the ground needing warm rains. Hepatica triloba coming in bloom on the 28th and first mayflowers appearing.

May 2.—Hepatica fully in bloom; catkins of the populus tremuloides shedding pollen. Heavy showers, May 1, with cold north-west winds on the day following. First grain sowed.

May 6.—Flowers of red maple in full bloom. A few strawberry and white violet blossoms seen. Copious rains on the 6th, and on the 9th. Farmers busy planting on the 7th.

May 12.—Frosts on the night of the 8th and again on the 12th when ice one-fourth inch thick was formed, followed by a mixed hail, snow and rain on the 13th.

May 14.—Quite cold. A few blue violets in bloom, white violets and strawberry blossoms in abundance; with dandelions, trillium erythrocarpum, caulophyllum, trillium grandiflorum, coming in blossom.

May 22.—Wet, cold and backward weather the past week. Trees in leaf: betula papyracea, rowan, acer spicatum. In flower: marsh marigold, sanguinaria canadensis, anemone nemorosa, uvularia sessilifolia, bluets, erythronium americanum, vaccinium canadense, dirca palustris.

May 29.—Beautiful weather the past week but the evenings still cool. Amelanchier in full bloom, also trillium erectum, trillium grandiflorum. Upland trees all out in leaf except oak, acacia and great toothed poplar. Prunus Pennsylvanica coming into bloom.

June 6.—In bloom: Bog-bean, butter-cup, caraway, also clematis verticillaris, iris versicolor, actea alba. Heavy frost on the night of the 6th, which did much damage on low grounds.

June 11.—Three nearly ripe strawberries picked along railway track. The different varieties of pyrus baccata, caragana arborescens (not native) and apple trees in full bloom.

June 14—Lilacs coming in bloom. Petals of clematis verticillaris and trillium grandiflorum falling.

June 21.—During the past week and nearly all the month up to date the weather has been cold and wet, but grass and foliage have grown abundantly. The weather, June 15 and 16, was very bright and warm, giving promise of summer which was not fulfilled for a week at least. A fire in the grate all day from the 18th to the 21st had to be kept up. Lilacs and honeysuckles in full bloom the past week.

The months of July and August were very pleasant and sunny except at the coast where fogs reigned for many days at a time. September was wet and chilly much of the month, with frosts during the early weeks. Quite a severe frost and keen weather on the 19th, followed by rains. A week later, real autumn days, bright and pleasant, set in and continued during the month of October. Rarely has a finer October been seen in New Brunswick. There was very little rain-fall during the latter part of September or during October and November, and the lakes and streams were correspondingly low.

The first snow fall of any importance was on the 10th of December, which gave good sleighing for a fortnight or more, but there was no severe cold during the month.

ARTICLE VII.

WHY IS THE WINTER SO MILD?

By G. F. Matthew.

Read February 6th, 1906.

The unusual character of the current winter season has caused a good deal of comment, and certainly there will be few living who can recall such another. Coming after the severe and continuous cold of the previous winter and its accumulated snows, the contrast is very striking. In place of deep snow banks, heavy ice, and the continuous cold of last winter, we have been treated to but one honest snow storm and to repeated periods of mild weather, with some rather heavy rains; so that now the snow has disappeared and the ice on the rivers has become unsafe.

While not professing to be a weather prophet, one might suggest a peculiarity in the weather of the past summer and fall as a probable factor in the present conditions.

It will be within the recollection of some of you that the St. John river during the past season was unusually low—not only for a short time in the later summer as is usually the case, but continuously through the summer and throughout the autumn. We had no autumn rains that were of any weight and consequently there is no "fall freshet." Usually the water in the river at the autumnal period rises sufficiently to cover the lower or marshy part of the intervals, and not infrequently to cover the "high marsh" as well, while occasionally there are autumns in which the "fall freshet" rivals that of the spring.

The level of the water in Kennebeccasis Bay and other expansions of the St. John river is governed not by the rains on the lower affluents of the main stream, but by the rain-fall of the basin of the St. John as a whole. The level of the water in these lakes at the mouth of the main river affords an excellent gauge of the rain-fall in northern Maine as well as for the principal part of the province of New Brunswick, because it is in such close sympathy with the rain-fall of the upper St. John.

Now all dwellers on the shores of Kennebeccasis Bay will

have noticed how unusually low the water was in that part of the Kennebeccasis river all through the summer, and through the fall as well. Old residents on its shores have told me that they do not recollect having witnessed a similar occurrence of continuous low water in the river. This conditions of things indicated a scarcity of rain throughout northern Maine and New Brunswick during the period in question. But if there was a lack of rain there was more sunshine and in the autumn less evaporation, because the ground was dry. Consequently during the whole period the earth in this region was storing up an unusual amount of heat, to remain there until the winter set in.

During the winter this region has been giving off the latent heat thus stored up, and tempering the winter winds. It is in fact a heat barrier which may be compared to a heating register in front of a window which stops the cold draft from the window. In the same way this warm region arrests the north winds and throws them upward, or modifies their biting severity. More than that, as the extra amount of latent heat here, produces upward currents in the air over this region, there is more than the usual tendency to indrafts from the south, and southerly winds should be more prevalent than under ordinary conditions. Not only so but the west and east winds would be influenced as well.

Many of you are no doubt aware that a "northeaster" is a combination due to an under current from the north and an overhead drift of air from the east, or off the ocean; the former wind dry and cold, the latter laden with moisture; that origin of the northeast rains is not unfrequently well shown by clouds arising in the southeast and rain actually beginning from that quarter, before the "northeaster" sets in.

The point I wish to make in this connection is that the tendency of the air in the super-heated region of Maine and New Brunswick to rise more strongly and more frequently than usual, would tend to convent the northeast winds into east and southeast winds and so bring rain in place of snow. A similar result might be looked for at the opposite point of the compass, for there would be a tendency for south and southwest winds to take the place of southwest and west winds, again bringing warmer air from those directions.

You will no doubt infer that the latent heat stored up in the soil during the summer is gradually dissipated in the winter; the question therefore arises, is the unusual store of last summer now reduced to the normal amount at this season of the year? I think not, for it is well known that the frost this winter has penetrated but a short distance into the ground, and in consequence there is a considerable part of the summer store of heat still remaining. This, as it escapes, will have a tendency to melt the snow from below, and almost imperceptibly reduce its quantity; while the rays of the sun, becoming every day more powerful, will cut away the snow-banks from above, even when snowstorms come, as they no doubt will, to cover the bare earth.

In considering the influence of the unusual amount of latent heat stored up during the past summer in Maine and New Brunswick, in modifying our usual winter conditions, I have made no reference to the last summer's climate beyond these boundaries; that is a lrger question with which I am not prepared to deal, but those who may look farther afield will probably find that the summer changes in the surrounding regions were not dissimilar from those that prevailed in Maine and this province.

To sum up the matter, I may say that the mild winter of this year appears to me to be largely due to the unusually long dry season of the summer and autumn of 1905.

The following notes on mild and cold winter's in this province, are from the pen of Rev. W. O. Raymond, a well known writer on its history.

Old-Time Winters in New Brunswick.

The idea which commonly prevails that our winters are milder than they were in the days of our grandfathers seems to have little foundation. The fact that the present winter has proved an uncommonly mild one is more than offset by the fact that last winter was the most severe of any in the memory of those now living. It is not likely that there has been any material change in the climate of St. John since its discovery by Champlain.

James Simonds, who may be considered as the pioneer of English settlers at St. John, writes of some of the winters of his day. Under date March 6, 1769, he says: "Have had but little snow this winter, but few days that the ground has been covered." Again on Feb. 18, 1771, he writes: "There has not been one day's sledding this winter, and the season is so far advanced there cannot be much more than enough to get the hay from the marsh."

Extracts from the diary of Rev. Frederick Dibblee, the first rector of Woodstock, N. B. also show that mild winters were not uncommon a century ago. On December 25, 1803, he writes: "A fine Christmas, there is not an inch of snow. Ice closed last night." By way of contrast we find that the next winter sleighs had been to Fredericton prior to the 22nd December and found good travelling all the way, which was a thing quite unusual on the upper St. John, the current being in places quite rapid. The winter of 1807 was remarkable for mildness. Mr. Dibblee writes on the 8th. of January: "River open, only five cold days to date, we never had such weather." This was followed a few days later by a snowfall of 18 inches, but on February 19 he writes: "After amazing heavy rains the ice ran today, nothing but a little ice left on the roads and scarce any snow in the woods."

Coming down to more recent times we have evidence of mild winters. A worthy resident of Lower Norton, Kings County, Azor Hoyt, writes in his diary on the 10th February, 1824 "a violent storm, with heavy gale of wind for 36 hours, broke up the river, sweeping away bridges, stacks of hay, timber and fences."

A few days later he writes, under date February 16th: "River opens; carrying off hay from the marsh in my boat." On December 25th, 1829, Mr. Hoyt writes: "A green Christmas, very warm, grass quite green." The ferry at Hampton was in use a good part of the winter. The next winter was even milder. The last of December the river (Kennebeccasis) remained open, with warm weather, and on January 1st, 1831, a warm rain brought the river up over its banks. On March 20 Mr. Hoyt writes. "No frost in the ground, warm all February and March."

The winter of 1839-40 was remarkable for its mildness. About the end of December the Woodstock Times says: "The weather continues highly favorable, and the ground is still bare. The river flows as free as Arno's tide." There was a green Christmas. The winter of 1847-8 was also unusually mild. The St. John river closed about the 20th November, but warm weather and heavy rains caused the ice to run out about the 10th of December. This gave opportunity for Lady Colebrooke to make her famous winter trip from St. John to Fredericton in the Carleton Ferryboat, which bore her name—the "Lady Colebrooke." The boat left St. John on the afternoon of Tuesday, the 14th December, and arrived at Fredericton early the next day. On her return trip she brought a number of students from the university to spend their Christmas vacation, among them Dr. W. P. Dole, who wrote a very interesting account of the trip for the St. John Globe under date 5th February, 1889.

N. B.—As bearing on the question of seasonal changes and the condition of the weather in New Brunswick, attention is directed to the "Notes" of the Director of the St. John Observatory for the past year which will be found at the end of this Bulletin, and also to Dr. G. U. Hay's notes on the Weather and Plants on a previous page.

APPENDIX.

Summary of the President's Address.

A rule of the Society, usually honored by its observance, is that the President shall annually deliver an address. During the term of years in which you have so kindly entrusted me with the position which I occupy I have tried to discharge that duty though quite conscious of the fact that I must fail in the effective presentation of any special subject along the lines of the particular studies of an organization which has in it several eminent students of natural science.

It is recounting an oft-repeated tale to refer to the three summer outings which we had in the year just past. I was not able to get to the first, that on Mr. Banks's domain, at which several of our members came into pleasant contact with nature at least consciously — for the first time — and enjoyed most heartily inspection of some of her treasures; but I was fortunate as regards that at Mr. Hay's summer cabin near our river, and that at the pleasant shack of Messrs. Leavitt and McIntosh in the Nerepis Valley. Those who participated in these delightful outings—not a small number by any means—cannot fail to remember how eagerly they quaffed the wine of delight which nature so generously held out to them as she enticingly urged them to follow her over hills and along pleasant slopes and into charming glens, how readily they looked and listened under sheltering trees as their wise teachers unravelled before their wondering eyes some intricate piece of nature's handiwork and illuminated them with knowledge of the life which seemed no part of their lives, and yet which existed all about them. Those of us who are not in the very centre of this learned society, who can scarcely even be called gleaners in the field of science, and whose best contribution to scientific work is the close attention which we give, the hearty admiration which we bestow upon, the workers who are able to go to the very core of things, who by close study and patient investigation wrest from Mother Earth some of the secrets

which she discloses to her true worshippers, owe much to the gentlemen who plan and who effectively provide such delightful outing days as we had in the year. If there be any pensiveness at all, of which I am doubtful, it can be only in the hearts of those who are not so able as they once were to crawl into dark caves, to jump over running brooks, or to climb the steep hills that are sometimes encountered in the expeditions, which, when one comes up against them suggests a hope that, as in the ballad of the Pied Piper, some mysterious music will open them for us and we shall get to the other side without trouble to ourselves.

In observations which I had the honor to address to the Natural History Society a year ago reference was made among other things to that theory of matter—the monistic theory—which dispenses with the idea of a creative force in, or rather outside of, the material universe, which finds in matter itself and in matter alone all the forces which are sufficient to create worlds, the men and animals which live in them, the trees and plants which cover them, a theory which "has excluded from the story of the earth all questions of miracle, all questions of supernatural agencies in the building of the mountains and the shaping of continents;" which practically teaches that it is an arrange ment or re-arrangement of the atoms of the universe and their relation to each other which makes not alone the material man but also the intelligence which man displays and the intellectual forces which apparently so strikingly differentiate the matter of which he is made up from the matter in the blocks and stones and insenate things which he can use for his own purposes, which things in a general way are supposed to be made for his use.

According to this theory the universe is one great whole and the moral and spiritual life of man is a part of this cosmos; there are not two different separate worlds, the one physical and material, the other moral and immaterial. This may be held to suggest or to suppose a purpose in nature which has not yet been discovered by man, which makes him but a simple element in natural processes, of no special account in the great drama of creation, of no more importance in the general scheme—whatever that scheme may be, if there be a scheme at all—than the

moth whose existence is but that of the summer day; or else it may suggest that there is no purpose whatever in the universe, and that the atoms do nothing but continuously arrange and rearrange themselves in new forms and shapes and conditions and affinities as do the clouds in the sky. You may recall Shelley's poem in which he describes the cloud, the nursling of the sky, passing through the pores of the ocean and shores, changing but never dying, so that when the pavilion of heaven is bare the atoms of which it is composed come from the caverns of rain, from the earth and water, into which they had receded and build up in the blue dome of air the cloud's own cenotaph, and having done this these atoms in the ever changing state of things as quickly unbuild it again. This might be a poetically descriptive picture of the changing portions of the universe, a presentation in our atmosphere in a short hour of what is done in myriads of years in the creation and dissolution of worlds in the infinity of space. But you may say that this is fanciful rather than exact.

In his address before the British Association at its meeting in South Africa last August, Prof. Darwin, the President, intimated his belief that the stars have a life history, they pass in order from youth to age; the inexorable sweep of time is operative upon them as upon fragile human bodies; like human bodies, although at an indefinitely slower rate, they grow, they attain maturity and decline. But to say this reveals us nothing. "A real beginning of creation evades our keenest scrutiny of material things and their relations," says a writer in a recent issue of the *Monthly Review*. So long as man shall last, says Prof. Darwin, "he will pursue his search into the intricacies of nature and will no doubt discover many wonderful things, which are still hidden. We may indeed be amazed at all that man has found out but the immeasurable magnitude of the undiscovered, will, throughout all time, remain to humble his pride. Our children's children will still be gazing and marvelling at the starry heavens but the riddle will be never read."

At the close of 1905 this is the last word of cosmical science. We know or we think we know that the Pleiades were formerly a nebulous formation in which there were no stars, that they will in the future become a stellar system freed from the frag-

mentary nebulae still attached to them, and we can apply this knowledge to the heavenly system, speculating if we choose upon the fact that the whole universe is subject to the law of evolution, that just as there is a struggle upon our humble earth for the eventual survival of the fittest so there is such a struggle in the world outside and beyond us, and that similarity stands out again in their constructive career, and the process goes on and on, beyond all human conception of time and space.

Interesting as may be the study of methods or theories or suppositions as to the life of the bodies of which we have any knowledge and which make up the universe which we know, this reference to it does not cover any determination on my part to discuss it at any length now. Having stated this I may say that my simple and yet chief desire is to make a few observations along another line. If we refer the origin of all organized matter to a single substance divided into atoms, or into ions much more minute than atoms, and if we accept even in the most modified form the theory that in the protoplasm of this organized matter is the principle of life, that from this substance, out of it, through it, by it, proceeds in some way the simple cell which has developed into man with his high intelligence, marvellous capacity for thought, and filled with hopes of an immortal existence, in what position are we to reject the idea that in everything that grows, in everything which has life, whether vegetable or animal, there is a consciousness of that life; sensations, feelings, and, of course some form of thought. Dr. Hay in an address which he delivered before us on the occasion of one of our summer outings, called attention to the well known capacity of some members of the plant world to seize upon insects for food, and to the sensitiveness of other plants to the touch. In the past summer he interested us particularly in a branch of a tree growing upon his grounds, which showed what might almost be assumed to be an intelligent and an ingenious and surely successful effort on the part of that branch to get out into the sunlight and to secure in a way a very pleasant site for its occupation. In another number of a journal which I have already quoted—the *Monthly Review*—W. T. Clark Nuttall says that it is impossible to refuse to acknowledge plants as sentient beings or deny

that they are capable of experiencing sensations, and that the more we study plants the more impressed we are with the conviction that we have in them a line of development parallel to our own, but one situated in a lower plane, whose scale is pitched in a lower key. I quote a few paragraphs from Mr. Nuttall's attractive article.

"Of late years the student probing deeper and deeper into the mysteries of plant life has been increasingly struck with the analogies that exist between the plant and the animal kingdoms. Over and over again in his researches among plants animal-like characteristics confront him in so persistent and surprising a way that the conviction is forced upon him that, beneath the wide divergences that undoubtedly exist between the two kingdoms, there must be some fundamental term common to both. The living plant and the living animal, remote as they appear to be in their highest developments, must still be bound together by some subtle link. And reflection shows him that that link can be nothing else than the possession of the indefinable quality, life. That which he calls 'life' he realizes must be of the same nature and quality in both kingdoms, and the distinction between them lies, he is beginning to assert, merely in variation as to the quality and intensity of that possession. Indeed it has been suggestively remarked that 'life sleeps in the plant, but wakes and works in the animal.'

"Now when we look down the long vista of the animal world from the highest to the lowest our glance passes from man to apes, past birds and reptiles, fishes and frogs, on by worms and insects and jelly fish, and past the animal communities that we call corals and sponges, until finally we come to the end of the line and find the simplest form of animal life to be merely a mass of living protoplasm enclosed by a more or less definite wall, though still exhibiting certain characteristics of an animal.

"And when we change our point of view to the plant world a similar vista of complex forms successively simplifying meets our eye as we range from chestnut and lily, pines and ferns, to mosses, liverworts fungi, seaweeds and green algae, until at length we come to the simple plants which are also merely a mass of living protoplasm invested with a cell wall, though still en-

dowed with definite plant-like characteristics. Thus then do the vistas of animal and plant life converge towards one another.

"In a problem such as this we can only deduce conclusions by inference and presume similarity in those of our own kind. We can say that others have similar feelings to our own because they act in a similar way to us under similar circumstances—we can never directly test their feelings. And as we work backwards from man there is no single place at which we can stop and say: "there is no sensation here." For wherever there is life there is adjustment to environment—response to external stimuli—and there is no point in the sequence of animal life at which we can assert that the response of any individual is purely that of an automaton.

"And it is this question, the question, 'Are plants sentient?' that plant students are asking more and more closely to-day about the whole plant kingdom in general. For some of the forms of plant-life exhibit so close an analogy to animals in their apparent possession of sensation that, since the sequence of life is unbroken in the organic world, it seems an arbitrary distinction to allow the attribute in one part of the sequence and deny it in another. Some observers, indeed, go even further, and are beginning to wonder whether or not it is not possible that plants may be actually guided by some form of intelligence, an intelligence diffused indeed, and not gathered up into a brain focus, but nevertheless present in some general form. Certain of those who are well-fitted to judge, even make definite affirmations on the point. Thus Professor Shaler, of Harvard University, recently declared that: 'we are in no position to say that intelligence cannot exist among plants, for in fact, all that we can discern supports the view that throughout the organic realm the intelligence that finds its fullest expression in man is everywhere at work.'

"But whether we are justified in presuming intelligence in plants or not, the contention that plants are actually endowed with sensation has been considerably furthered of late by some researches that have been made at Graz by Prof. Haberlandt, a German botanist of some repute. He has been studying the subject specially among the high flowering plants, and as a result

of his investigations he claims to have found definite organs of sense in certain cases. That is to say, he has found and examined a number of plants, as we might examine animals, for organs for the reception of the sensations of touch, and he asserts that he has found complete analogy in many instances between plants and animals in their sensitiveness to contact."

It is not necessary for me to follow Mr. Nuttall in the observation which he makes upon the possession of organs such as that of touch in at least some plants as, for example, the Passion flower, the sensitive plant, the Venus fly trap, in plants which are what we call climbers, whose tendrils are as sensitive at least as the tentacles of the sea-urchin. Tendrils are, he says, like our finger tips, reaching ont into the world to place the individual in its environment. During their time of growth they move in continuous circles round and round seeking with sensitive surface for some support for the plant in its upward climb, and once they come into contact with a solid body the measure of their twining is the measure of their sensitiveness. In addition to this, and the many instances which Mr. Nuttall gives of the sensitiveness of plants, he declares that they are able to transmit a stimulus from one part of their structure to another part. In animals this is, of course, done through the nervous system; the plants have no known nervous system. The idea is now refuted or outgrown that it can be through the cellular system, as each cell is distinct of itself. and his conclusion is that the protoplasm of a plant, continuous through the entire plant, is the medium of transmission, the contents of each cell being connected with those of the adjacent cells by very fine strands which pass through the walls of the cells in every direction. Hence, he says, a plant possesses a complete inner structure of protoplasm hidden within its outer walls, and we have no difficulty in understanding that a stimulus can be carried from one part to another just as nerves carry sensation, for after all what is our nervous system but protoplasm modified in a very special way.

In regard to this, it is well to remember that this view somewhat differs from and disagrees with the recognized theory that there is a central organ—the brain—which diffuses consciousness throughout the system, that in whatever part of the body sensa-

tion—whether by touch or otherwise—is aroused intelligence of it is transmitted to the brain, the central office—which informs the whole body of what it has just received, and thus the entire system is made conscious of the occurrence. Indeed some of the older naturalists made a distinction—which may yet exist—between sensation and consciousness, holding that while man and the higher animals had consciousness the lower animals were cognizant of sensation only. This is easily interpreted into the idea that consciousness is the capacity to express sensation. Certainly so far as an intelligent statement may be made of these things we can easily believe that Dr. Hay's tree in its effort to get into the sunlight, vegetable though it is, shows quite as much intelligent consciousness as is displayed by the clam or the oyster in its environment. Probably a good deal more.

One word more in regard to consciousness only. What is it? Are we fully conscious of all of our own consciousness? Mr. Mallock lately made the observation that "if we call a man's self those faculties and processes which are going on in his own organism, he is as ignorant of the larger part of himself as he is ignorant of what is happening in the moon or the milky way. It is enough, in illustration of this, to mention the case of memory, in which each of us is a crowded register of things which we have never noticed, and of which it betrays its custody under rare conditions only." The common wild rabbit or hare of this country changes its coat in winter, and there are some who believe that it does so in order that by its resemblance to the snow, by its mimicry of nature, it will protect itself from its enemies. Is it conscious of the change, does it put forth a conscious effort to bring this about? Look at that curious insect which is so like the branch of a tree or shrub upon which it feeds, and which we are again told assumes its color and marking so that it may escape its enemies? Is it conscious that it is thus protected? Consider the lilies of the field. Do they, or did they, know that Solomon in all his glory was not arrayed like unto them? But I must end my questionings?

We get back to the fact that as observation is more close and more definite regarding the life upon our planet, to the atoms, the substance, of which the universe is composed, there seems

to be a force, a creative, life-making power in the original elements which is beyond the animal and the vegetable world, which was in the nebulæ and before it, and which is yet in existence; and whatever changes take place by chemical combinations, by differentiation, variation, or whatever word may be chosen to express the idea, or by whatever process these combinations may be brought about, the same principle obtains in all; and it is not difficult to assume that there is an elementary property in the atoms of the universe which gives birth to all the life that the universe contains, built up from the arrangement of these atoms. But this does not explain the whole mystery. The tree grows and so does the man; so does *not* the rock crystal or the diamond, and no one attributes consciousness or sensation to these latter, and yet they are of the elemental substance.

It is well to remember that even in the limited sphere of our own earth the work of creation is not ended, and that apparently there are new creations constantly coming into notice, some of them probably supplementary to, or taking the place of the old. Dr. Matthew easily tells us of transitions of life on this earth in the animal kingdom which have taken millions of years to bring about, and of geologic eras of such duration, one succeeding the other, that no one would attempt to estimate their age. Doubtless we are living in one which some men in the distant future may speculate upon with no consciousness whatever of the thoughts and hopes and fears and reasoning of the men who live today.

In a paper upon orchids which lately appeared in an English magazine, the writer argued that the orchid is a comparatively modern adornment of our earth, and he supported his view with two reasons for holding it, one that the insects—bees and the like —which are necessary to its reproduction—did not come upon the earth until after the carboniferous era; the other that while yellow, white and red colors early developed when the efflorescence of plants began to change from its original green, these colors were well established before blue made its appearance, that the blue orchid is yet rare, because sufficient time has not elapsed for its diffusion or its development.

Assuming then, that new forms of living matter are still

coming on the stage of existence by some process of development or expansion, it is not difficult to speculate upon the possibility, even the probability, of existing forms disappearing as, of course, some forms do disappear through various causes. There are both animal and vegetable growths. once abundant, which exist no longer except as fossils or in some state of preservation in the earth's crust, and there are abundant evidences of the previous existence upon earth of a life of which we cannot now have adequate conception. It is easy to assume that these died out because of changed conditions of temperature or other climatic causes in the regions in which they flourished, through exhaustion of the soil, or in some similar and not unnatural way which no longer fitted them for their environment.

There was a time when the investigations which are carried on by such organizations, as ours, when men who carried them on, were regarded with grave suspicion by those who believed that the knowledge thus acquired might prove dangerous or was useless of itself; and when some discovery was made which conflicted with generally accepted facts, fears were excited in timid minds that the whole fabric of society might be destroyed. That fear may be said to no longer exist generally, even though there be some who yet look with suspicion on the work of the scientific investigator into the doings and the order of nature. These investigations have greatly enlarged the sum of human knowledge and increased the sum of human happiness. Reading lately an essay of Mr. W. Hamilton Mabie, I came across a paragraph in which that writer observes that it is difficult now to realize how completely nature was lost to men during the middle ages, how comparatively untouched human life was by association with the countless aspects of sea and sky. For several centuries the great mass of men and women were so estranged from nature that they forgot their kinship. Of course, in every generation there were men and women to whom the beauty of the world did not appeal in vain, but their perceptions were limited by lack of the larger insight and larger vision. The popular ballads of these days were not lacking in pretty bits of description and sentiment, but nature is subordinate; the sublime background, against which all modern life is set, is invisible Mr. Mabie observes that it is difficult

to imagine a time when men had no eyes for the landscape, and yet, he adds, that is is a notable fact that Petrarch was the first man of his period to show any interest in that great vision which a lofty mountain opens, and which has for the men of today a delight so poignant as to be almost painful. After relating the incident upon which this statement is founded he goes on to remark in a paragraph which we all here will appreciate:

"The redemption of nature from the shadow of sin which, to the mediaeval mind, rested upon and darkened it, has been very slowly accomplished; but the poets, the naturalists, and the scientists have taught us much, and our hearts have taught us more. Nature has become not only an inexhaustible delight, a constant and fascinating friend, but the most vital and intimate of teachers; in fact, it is from the study of nature, in one form or another, that much of the advance in educational efficiency has come; not the improvements in method, but the freshening and deepening of the educational aim and spirit. Nature, through the discoveries of science, has restored balance to the mind, and sanity to the spirit of men by correcting the false perspective of abstract thinking, by flooding the deepest questions with new light, by bringing into activity a set of faculties almost disused, and by adding immeasurably to the resources of the human spirit. In the Middle Ages attention was concentrated upon the soul, and men learned much from the eager and passionate self-questioning; but it was a very inadequate and distorted view of life which they reached, because one of the great sources of revelation was left untouched. In modern times the world of nature has been searched with tireless patience, great truths relating to man's place in the sublime movement of the universe have come to light, and the distorted vision of the inward world has been corrected by the clear vision of the outward world. The study of nature has yielded a new conception of the nature of the divine will expressed through law, of the divine design interpreted by the order and progress of the phenomena of the physical universe, of the marvellous beauty of the divine mind which Tennyson was thinking of when, looking long and steadfastly into the depths of a slow-moving stream, he cried out in awe and wonder, 'What an imagination God has.'"

Men are saner, healthier, wiser, since they began to find God

in nature and to receive the facts of nature as a divine revelation. The soul has looked away from herself and out into the marvellous universe, and learned from a new teacher the wonder, the beauty, and the greatness of her life.

In my address last year I began with a reference to the need which we have for better and more comfortable quarters. This year I close by saying that want still exists, but there is at least a faint glimmer of hope that the difficulties under which we labor will not last forever. Not only do we want more comfortable quarters but we need improved facilities for the illustration of the subjects which are discussed in the lecture room. Those of you who were fortunate enough to hear Mr. Burdett's lecture upn meteors and shooting stars must have been struck by the ingenuity which he displayed in exhibiting his illustrations, but it sharply revealed our poverty. It is worth an effort on our part to overcome these difficulties; for the work of this society is a most useful one—useful in its direct effects and in its influences. In an address which he delivered before the new students of Harvard University in October last President Eliot inquired as o what are the solid and durable satisfactions of life, and after pointing out some of these he emphasized the fact that large mental enjoyments should come to educated people, the great distinction between the privileged class who can look across the ample pages of the Book of Knowledge and the large class who have not that opportunity is, that the former lives mainly by the exercise of the intellectual powers, and gets therefrom a much greater enjoyment out of life. His address was to young men entering upon a college career, but some of his observations are applicable to us all, old and young, men or women. The use of our intellectual power, the steady exercise of our reasoning faculties, the constant acquisition of knowledge will increase our happiness and add to our zest of life, no matter how severe our labor or how many hours we have to give to the procuring of our daily bread. We may not be students of any particular university, but the doors of the great university of nature are never closed; its halls are broad, its lessons fruitful, its studies simple or severe as we make them for ourselves; its diplomas are written upon hearts and minds in indelible ink, the records of success in faithful labor in the earnest search for Truth.

FORTY-FOURTH ANNUAL REPORT
OF THE
COUNCIL OF THE NATURAL HISTORY SOCIETY
OF
NEW BRUNSWICK.

The Council of the Natural History Society of New Brunswick desire to lay before the members a summary of the work done during the year ending December 31st, 1905.

Membership.

During the year the membership has been increased by the admission of two ordinary and nineteen associate members, and one corresponding member, making a total of 200.

The following shows the numbers, classes and total enrolled membership:—

Honorary,	4
Life,	6
Corresponding,	25
Ordinary,	55
Associate,	106
Junior,	4
Total,	200

Treasurer's Report.

Income—

Balance from 1903-4,	$241 93	
Interest on Investments,	85 52	
Bulletins Sold,	50	
Mounting Paper Sold,	25	
Government Grant,	200 00	
Membership Fees,	202 00	
Rebate on Ins. Prem.,	1 14	
Collected on Field-day—Oliver's Cave,	3 50	
		$734 84

Carried forward,		$734 84
Expenditure—		
Maintenance of Museum,	$138 30	
Library Books and Binding,	13 16	
Printing and distributing Bulletin XXIII,	160 00	
Sundries,	170 44	
		$481 90
Balance Bank of N. B.,		$252 94

The above balance of $252.94 includes $33.00 held in trust for the Ladies' Association, and $40.00 for Botanical work as set forth in the 1903 report.

The Society holds mortgage of $1,500.00 on Hazelhurst property.

The Society holds mortgage of $900.00 on Cheyne property.

The Society holds special deposit in the Bank of Nova Scotia $100.00. The Society holds special deposit in the Bank of Montreal Building Fund $12.56.

The collections are insured for $3,500.00.

Respectfully submitted,

A. Gordon Leavitt,

Treasurer.

January 16, 1906.

Lectures.

Ten regular meetings, including the annual and one special meeting, were held during the year.

The following are the dates of the meeting and the titles of the papers read:

January 3.—(a) Birds that Hunt and are Hunted, by Mr. A. Gordon Leavitt.

(b) Additions to the list of New Brunswick Plants, by G. U. Hay, D. Sc.

(c) The Curious Phenomenon of a Forest Fire near Neguac, Northumberland Co., by W. F. Ganong, Ph. D.

January 17.—Annual Meeting. Election of Officers.

February 7.—(a) The Magdalen Islands: Their People and History, by Mr. W. F. Hatheway.

(b) Physiography of Grand Lake and its Affluents, by Mr. W. S. Butler.

(c) On the Limits of the Great Miramichi Fire in 1825, by W. F. Ganong, Ph. D.

March 7.—(a) Pain, by G. G. Melvin, M. D.
(b) Archaeological Notes, by Mr. S. W. Kain.
(c) On the Contour Map of New Brunswick, by W. F. Ganong, Ph. D.

April 4.—(a) Notes on Our Insect Collection, by Mr. William McIntosh.
(b) Notes on a Grindstone Quarry at Stonehaven, Gloucester Co., by Geoffrey Stead, C. E.
(c) On the fact basis of the Fire or Phantom Ship of Bay Chaleur, by W. F. Ganong, Ph. D.
(d) Notes on Our Fishes, by Mr. C. F. B. Rowe.

May 2.—(a) The Natural History and Physiography of New Brunswick, by W. F. Ganong, Ph. D.
(b) Bird Notes, by Mr. J. W. Banks.

June 6.—(a) The Hydrography of New Brunswick, by Mr. J. W. Bailey.
(b) Geology of Rockwood Park, by G. F. Matthew, D. Sc.
(c) Report from the Royal Society of Canada, by G. U. Hay, D. Sc.

October 3.—Vegetation of the Earth in remote times and its Relation to Climate, by G. F. Matthew, D. Sc.

November 7.—Gypsum Deposits of Albert Co., by L. W. Bailey, Ph. D.

December 7.—The Physiographic Characteristics of the Tracadie River; On the Height and other Characteristics of Wilkinson Mountain; On Walrus Bones from Miscou Island, by W. F. Ganong, Ph. D.

Elementary Lectures.

A series of Elementary Lectures or Talks was given in the rooms on Tuesday evenings, not occupied by the regular meetings of the Society, during the months of January, February and March, for the benefit of the Ordinary and Associate members, and for pupils of the public schools. These lectures proved very interesting and were fairly well attended.

The following were the dates and the titles of the papers read:—

Dr. G. F. Matthew gave two lectures on the Elements of New Brunswick Geology, January 10 and 24.

January 31.—A Preliminary Talk on Plant Life, by Mr. Thomas Stothart.

February 14 and 21.—The Trees of New Brunswick, by Dr. G. U. Hay.

February 28.—On Bird Classification, by Mr. A. Gordon Leavitt.
March 14.—On Types of Insects, by Wm. McIntosh.
March 21 and 28.—On Fishes, Reptiles and Frogs, by Mr. Chas. F. B. Rowe.

Publications.

The twenty-third Bulletin of our Society has been issued and copies sent to the members of the local legislature of New Brunswick and to other Societies. It contains many articles of interest on the natural history of this Province. Dr. W. F. Ganong continues in this issue his notes on the Natural History and Physiography of New Brunswick in addition to papers by other members.

Ornithology.

The numbers refer to the list of birds printed in Bulletin No. 1, 1883.

Species which occur in St. John and Kings counties:

115.—White Gyrfalcon (Hierfalco gyrfalco candicans) now Falco islandus).

The only evidence of the occurrence of this bird in this vicinity given consists of reports from persons who were certain they had seen it, but it now affords me much pleasure to record the taking of a beautiful female, on January 13th in the vicinity of the "one mile house," St. John County, by A. L. McIntosh.

This specimen is extremely dark and would, no doubt, answer the descriptions given of (Falco rusticolus obsoletus) by Cowes, Ridgway and others, but, at present, I prefer to follow McIlwraith who claimed that there was but one species, and not two and also two sub-species.

197.—Ruddy Duck (Erismatura rubida) Ordinarily considered a rare bird.

I reported a male and female in Bulletin XVI (Page 74), a female in Bulletin XVII (Page 170).

Note—During October 1905 I saw in the country-market eighteen specimens of this bird, most of which came from French Lake, Sheffield.

179.—Pintail (Dafila acuta).

The list says: "This species was not uncommon here some eight or ten years ago, but the only known recent instance of its occurrence anywhere in the Province is of a female and young brood seen on the Tobique River in September, 1879, by Mr. Carnell.

Note—A male and female seen at O'Neill Bros. stall in the City Market, September 26, 1905, a female at Dickson's stall on October 10, 1905, all came from points on the St. John River, but I could not learn the exact locality.

During the last few years quite a number of specimens have been observed in the market and city stores and it seems in order to now consider this bird as quite common.

A. GORDON LEAVITT.

LIBRARY.

The work of cataloguing the library has progressed favorably during the year. The books have all been re-arranged and many of the publications in pamphlet form placed in suitable cases. Up to the present time about half of the books in the library have been numbered and recorded on the list but much remains yet to be done. I had hoped to present at the meeting a complete catalogue of our library but other interests have made it impossible for me to devote much of my time to the library of late, and the work is still incomplete. Many valuable books including the transactions of the important scientific societies in America and abroad, as well as the various government reports, have been added to the library during the year and our shelves are now so overcrowded that further accommodation becomes a matter for the Society's consideration.

I would draw your attention to the fact that some of our books have been in the hands of members for many months and although a general appeal at our Society meetings and also through the daily press have been made, they have not been returned. A more thorough system in regard to the distribution of our own Society's bulletin is urgently needed, as many of our valuable exchanges were overlooked during the past year, and

many copies of the bulletin are distributed and this Society has no record of where they go. I wish to express my appreciation of the valuable assistance rendered by the Assistant Librarian, Miss Hoyt, in the work of the library during the past year.

W. Leonard Ellis, *Librarian.*

Field Meetings.

Three very pleasant Field Meetings were held during the past season, one at the Summer Camp of Mr. J. W. Banks, near the shore of Dark Lake, whence a visit was paid to Oliver's Cave in the vicinity; a second to Ingleside on the 5th of August; and a third to the summer camp of Messrs. A. G. Leavitt and Wm. McIntosh—Camp Nature,—above Nerepis Station on the 26th of August.

These meetings gave the large number of members who attended them a very pleasant outing and opportunities for social intercourse and visiting and gaining information about the interesting localities visited. Talks on the natural history features of each neighborhood—geology, botany, birds, and insects,—were given by the various leaders of the sections, and all the members felt that the time was well spent and voted the Field Meetings a great success.

G. U. Hay, *Chairman.*

Entomology.

Your committee begs to report that Messrs. McIntosh and Leavitt have devoted nearly all their spare time to collecting during the past year.

Insect collecting has been carried on unremittingly during the past seven years, resulting in the accumulation of a very large number of specimens and a vast amount of valuable data, with the result that henceforth we will be able to speak with some degree of certainty regarding the insect life of this section.

A number of species new to science have been discovered. A list of these will be published at an early data. A number of wall-cases have been prepared; in these are shown all the more common insects of St. John and Kings Counties, and the common

names are given where such exist. This collection will be enlarged during the coming year.

WM. MCINTOSH, *Chairman.*

BOTANY.

The Botanical Committee reports the discovery of a number of plants new to the province, some of which are from Miscou Island, reported by Dr. W. F. Ganong. These are held over for next year's report.

G. U. HAY, *Chairman.*

GEOLOGY.

Members of our Society have been engaged in active field-work during the summer, and have been in various parts of the province. Messrs. Leavitt and McIntosh have been studying and collecting in the Nerepis Hills, where the late destructive forest fires have laid bare large areas of granitic and other rocks. They have also been collecting fossils from the well known Devonian plant ledges in Lancaster, and have found some fossils of much interest to the geologist.

Professor Ganong has pursued his studies on the geology and physiography of Gloucester county, tracing the pre-glacial river valleys of the southeastern part of the county, and studying the recent geology of Miscou Island.

Dr. L. W. Bailey has been engaged in the search for fossils in the pre-Carboniferous rocks of York and Carleton Counties, and in obtaining information relative to the economic minerals of New Brunswick. Fossils collected by him were studied by Dr. H. M. Ami and were mostly of the marine animals called "graptolites."

Members of the staff of the Geological Survey have also been working in Charlotte county on the metamorphic slates of that portion of the province. These were Dr. R. W. Ells and Mr. Hugh Fletcher. The geology of this region is very complicated and difficult.

Dr. G. F. Matthew has been busy arranging and labelling the type collection of Devonian fossil plants, collected by the late

Prof. C. F. Hartt and described by the late Sir. Wm. Dawson. No other flora of such richness and of so great antiquity has since been found, so that the value of these types has been enhanced rather than impaired.

G. F. MATTHEW, *Chairman.*

GENERAL.

The rooms were open as usual to visitors on Tuesday, Thursday and Saturday afternoons of each week. Upwards of three hundred persons availed themselves of the opportunity of inspecting the various rooms. During the year the librarian, W. L. Ellis, M. D., devoted a great deal of his time to the re-cataloguing and re-arranging the books. All paper-covered works have been arranged according to the subjects treated of and placed in receivers; this with a handy reference makes them easily available. Dr. Ellis deserves the hearty thanks of every member for the excellent manner in which the work has been done. It is to be regretted that owing to the lack of space many valuable works have not yet been arranged to the best advantage.

Throughout the year the Ladies' Association heartily co-operated in all the work of the Society, giving their assistance on all occasions.

The attendance at the various lectures was most gratifying and the interest manifested gives good encouragement for the future. On several Saturday afternoons in the lecture room some of the teachers of the public schools gave talks to their pupils on Bird and Plant Life.

The curator, Miss Hoyt, has been untiring in her efforts to promote the interests of the Society. The Council wish to express their thanks to those gentlemen who have prepared and delivered addresses before the Society; to the donors to the museum and library; to the daily press for inserting the preliminary notices of meetings.

REPORT OF THE LADIES ASSOCIATION OF THE NATURAL HISTORY SOCIETY.

The Ladies' Association submit the following report for the past year:

At the annual meeting held in November, the following officers were re-elected unanimously: President, Mrs. G. F. Matthew; Vice-Presidents, Mrs. G. U. Hay and Miss A. D. Jack; Secretary, Miss E. McBeath.

The membership is still increasing and there are now over one hundred names on the list.

The subject of holding a Fair illustrating the History of Nations was discussed and approved by the members, the proceeds of which shall go towards a fund for a building that shall properly accommodate the Museum and Library and contain a suitable lecture hall.

It is hoped that the work will not be confined to the members only, but will become a matter of civic interest, and that our proposed new building may contain rooms suitable for the Historical Society and the Woman's Art Association.

The following course of lectures opened with a re-union on Thursday, January 5th. There was a large attendance of members.

January 12.—Emerson and Nature, by Mrs. Emma S. Fiske.
19.—Scenes in Rome and Naples, by Mrs. George Murray.
26.—Glimpses of a Quaint Old German Town, by Miss Homer.

February 2.—Children's Day—Nuts, by Miss Ethel Jarvis.
9.—Notes on China, by Mrs. James R. Warner and Miss Purves.
16.—Scenes from the Life of Huxley, by Mrs George F. Matthew.
23.—Some Relics of the French Occupation of Acadia, by Miss Alice D. Jack.

March 2.—Children's Day—Our Feathered Friends, by A. Gordon Leavitt.
9.—The Land of "Kai-ora," by Miss Olive.
16.—Voices from the Meadow, by Mrs. George U. Hay.
23.—Reunion of Members.

EDITH McBEATH,
Secretary.

K. M. MATTHEW.
President.

FREDERICTON NATURAL HISTORY SOCIETY.

The Fredericton Natural History Society is now entering upon the twelfth year of its history. Its meetings are held in the High School building, in the evening of the second Monday in each month, except in the vacation season. During the past year the programme for the monthly meetings was as follows:

1905.

Jan. 9. The Weapons of Birds, by Mr, Wm. Moore.
Feb. 13. The Annual Meeting. The Origin, Growth and Purposes of the Society, by the President.
Mar. 13. Vegetable Ferments, by Dr. John Brittain.
April 10. Some Queer Fishes, by Dr. L. W. Bailey.
May 8. The Hydrography of New Brunswick, by Mr. Joseph Bailey.
Oct. 9. The Gypsum Deposits of New Brunswick, by Dr. L. W. Bailey.
Nov. 14. Photography, by Mr. L. B Kidner.
Dec. 12. Lantern Views on Geology and Astronomy, by Dr. Bailey and Mr. G N. Babbitt.

1906.

Jan, 8. The Wild Animals of New Brunswick, by Mr. Wm. Moore.

To stimulate the younger members of the community to study natural history, the Society has offered prizes for each of the years 1904 and 1905. The 1904 prizes were awarded as follows:

Collection of, and Notes on Weeds; 1st prize, Miss Queenie Harrison, of Nashwaaksis; 2nd prize, Miss Mattie Moore, of Scotch Lake.
Collection of Insects; 1st prize, Master Kenneth Campbell, of Kingslcear.

In the early part of 1905 the Society purchased a reflectoscope at a cost of $150. It has since been used to great advantage in throwing upon a screen representations of the pictures of natnral objeets, or views of the natural objects themselves

The list of officers of the Fredericton Natural History Society is as follows:

L. W. BAILEY, Ph.D., LL.D., President.
MR. G. N. BABBITT, } Vice-Presidents.
MR. G. A. GOOD, }
B. C. FOSTER, M.A., Treasuree.
G. A. INCH, B.Sc., B.A., Secretary.
MISS ELLA THORNE, }
MRS. B. C. FOSTER, } Additional Members
MRS. G. A. INCH, } of the Council.
MR. WM. MOORE. }

DONATIONS TO THE MUSEUM, 1905.

DATE.	DONOR'S NAME AND DESCRIPTION OF GIFTS.
January...	Mr. James Manchester, Pres. of Bank of New Brunswick, Part of Bishop's Memorial Tablet recovered from the ruins of the Cathedral at St. Pierre Martineque.
February..	Miss Alice Rising, A case of Chinese Insects.
March.....	Dr. William Matthew, Collection of Minerals
	Mr. Duncan London, Several relics of the stone age. also Iron lance of the French period.
April.....	A G. Leavitt, Fossil shells snd Minerals found at Nerepis.
June	Mrs. Charles Lowe, Specimen of young alligator.
Octobcr...	Master Armstrong, Birds nest,
	Duncan London, Fragments of earthen pots and stone implements.
November	A Friend, Book of pressed seaweeds.
	A. G. Leavitt, Specimes of Rocks,
	Rev. C. J. Berrie, A plant that had grown and choked a water pipe.
December	Prof. W, F. Ganong, Bones of a Walrus.
	Prof. W. L. Bailey, Specimens of Gypsum.
	Mrs. Gilbert Murdoch. Nest of Trap Door Spider.
	Mrs. S. L. Gorbell. Specimen of Gulf weed.

DONATIONS TO THE LIBRARY, 1905.

Donor's Name	Residence	Works.
Academy of Natural Science	Philadelphia	Proceedin
Academie Imperiale des Sciences	St. Petersburg	Bulletins
American Entomological Society	Philadelphia	Circulars
American Museum of Natural History	New York	Bulletins
Australian Museum	Sydney, N. S. W.	Reports
Amherst College	Amherst, Mass.	Reports
Archaeological Society	Ontario	Reports
Boston Society of Natural History	Boston	Bulletins
Boston Free Public Library	Boston	Reports
Buffalo Society of Natural Science	Buffalo	Bulletins
Bureau of Ethnology	Washington	Transacti o
California Academy of Science	San Francisco	Proceedings
Cincinnati Society of Natural History	Cincinnati	Bulletins
Colorado Scientific Society	Denver	Transactions
Connecticut Academy of Science and Art	New Haven	Bulletins
Cornell University Library	Ithaca, N. Y.	Report
Comite Geologique	St. Petersburg	Report
Canadian Institute	Toronto	Transactions
Carnagie Institute	Washington	Report
Davenport Academy of Natural Science	Davenport	Proceedings
Director Royal Gardens	Kew, G. B.	Bulletins
Department of Inland Revenue	Ottawa	Report
Entomological Society	London, Ontario	Journal
Ethnological Survey	Manila	Report
Feuille des Junes Naturalistes	Paris	Journal
Field Naturalist Club	Ottawa	Transactions
Gray Herbarium	Cambridge, Mass.	Bulletins
Geological Survey	Perth, W. A	Report
Geological Survey	London G. B.	Report
Geological Survey	Ottawa	Report
Historical and Scientific Society of Manitoba	Winnipeg	Bulletin
Indiana Geological Survey	Indianapolis	Report
Iowa Geological Survey	Des Moins	Report
John Hopkins University	Baltimore	Circular
Linnean Society	New South Wales	Report
Literary and Historical Society	Quebec	Report
Liverpool Biological Society	Liverpool	Proceedings
Loyd's Museum	Cincinnati	Report
Manchester Geological Survey	Manchester	Proceedings
Minnesota Academy of Natural Science	Minneapolis	Bulletin
Minister of Mines	Sydney, N. S. W.	Report
Missouri Botanical Gardens	St. Louis	Proceedings
Maryland Geological Survey	Baltimore	Report
National Museum Library	Washington	Proceedings
New York State Museum	New York	Report
Natural Science Association	New Brighton	Bulletin
New York Academy of Science	New York	Journal
New York Public Library	New York	Bulletin
Ottawa Literary and Scientific Society	Ottawa	Bulletin
Philadelphia Museum	Philadelphia	Report
Public Museum	Milwaukee	Report
Queens Quarterly	Kingston	View
Rochester Academy of Science	Rochester	Proceedings
Royal Academy of Science	Stockholm	Proceedings
Royal Colonial Institute	London	Journal
Royal Geographical Society	London	Proceedings
Royal Society of Canada	Ottawa	Proceedings
Smithsonian Institution	Washington	Proceedings
South Dekota School of Mines	Rapid City	Report
Texas Academy of Science	Austin	Report
Tuft's Collage	Mass	Studies
University of Toronto	Toronto	Proceedings
University of California	California	Report
U. S. Coast and Geodetic Survey	Washington	Bulletin
U. S. Fish Commission	Washington	Report
U. S. Commission of Agriculture	Washihgton	Circular
U. S. Geological Survey	Washington	Report
Wilson Bulletin	Oberlin Ohio	Bulletin
Wisconsin Natural History Society	Milwaukee	Proceedings

NOTES ON NEW BRUNSWICK WEATHER FOR YEAR 1905.

By D. Leavitt Hutchinson.

January.—Highest temperature recorded in New Brunswick, 49.7 on 8th, at Grand Manan; Lowest —39.0° on 15th, at St. Stephen.

Exceedingly cold weather; temperatures much below zero were frequently recorded, that of the 15th ranging from 12° to 40° below zero, and in some localities probably lower. The snowfall also was exceptionally heavy, the storm of the 25th and 26th beng the fiercest for many years, completely demoralizing railway and other traffic. Owing to the absence of thaws, the accumulation of snow was unusually deep, especially at St. John, where the snow on the streets had greater depth than had been known for over thirty years; sleighing was good throughout the month, but roads badly drifted. The heaviest gale occurred on the 19th, with velocity of 50 miles an hour from southwest at St. John.

February.—Highest temperature, 44.7 on 13th, at Grand Manan, lowest —25.5 on 20th, at St. Stephen, Steady cold interrupted with but a few hours of thawing temperatures, high winds, abundance of snow in drifts of almost insurmountable magnitude, which blocked highways and railways and seriously interferred with movement of supplies, were the principal features of the month. Owing to almost no rainfall, springs and wells in rural dstricts were dry for weeks and cattle watered by melting snow. The highest wind velocity registered at St. John was fifty miles an hour from northwest during the gale of the eleventh, and the total wind velocity for the month was slightly over two thousand miles less than for the same month last year.

March.—Highest temperature 61.5 on 30th, at Chatham; lowest —25° on 15th at Sussex. March weather was comparatively mild and very dry with an unusual amount of brght sunshine, no storm signals were displayed and no gales occurred. The last snow fell on the 11th, and the exsessive snow covering gradually

melted away leaving a few patches of ice, but mostly bare and dry ground. There was little movement of river ice, but it has rapidly weakened; the total movement of wind for the month was fifteen hundred miles less than for the same month last year.

April.—Highest temperature 73° on 26th at St. Stephen, lowest 19° on 2nd at Dalhousie. The weather of the month was remarkably fine and mild. Precipitation was in all districts greatly below the average. Freshets were unusually light and lumber drives much hindered for want of rain. No storm of importance occurred; wind velocity at St. John measured three thousand miles in excess of April, 1904.

May.—Highest temperature 81° on 26th, at Chatham, lowest 11° on the 12th at Moncton. Cool, cloudy and wet weather were the prevailing conditions during the greater part of the month. A heavy frost occurred on the 13th., with temperature well below freezing. Towards the close of the month vegetation in most districts was backward but making good progress.

June.—June was comparatively cool and backward with rainfall above the average in most localities. A heavy frost was general throughout the province on the 7th, and considerable damage done to vegetables and fruit. The highest temperature was 92° at chatham, on the 16th, and the lowest 27.5 on 7th at Moncton.

July.—Highest temperature 92° at Chatham, on 7th, lowest, 35° at Dalhousie on 27th. The weather was, for the most part, fine and very warm. Near the Bay of Fundy, owing to the prevalence of fogs, it was somewhat cooler, with less bright sunshine. At St. John, southerly winds predominated and some slight damage was caused by lightning on the 27th.

August.—Highest temperature 91° on the 12th, at Chatham, lowest, 31° on 15th at Sussex. August weather was decidedly dry with almost continuous sunshine except near the Bay of Fundy district, where fogs were very prevalent during the first half of the month. Light frosts were generally reported on the 14th. Rivers, lakes and wells were unusually low owing to the drought, and forest fires caused destruction of much property in many parts of the province. A general and heavy rainfall was much needed. At St. John southerly winds prevailed during three hundred and ninety-three hours.

September.—Highest temperature 83° on 10th at Chatham, lowest, 27° on 30th at Sussex. An exceedingly dull and cool month, with excessive rainfall and few fine days; moderate gales occurred on the 13th and 26th. The total wind movement for the month at St. John was 2000 miles less than for the corresponding month last year. The heaviest and first killing frost was reported on the 15th. Trees retained their leaves but were gradually changing colour. At St. John five and a quarter inches of rain fell between the 4th and the 7th.

October.—Highest temperature 81° on 1st at Chatham, lowest 15° on 23rd at Sussex. An exceptionally fine, mild and pleasant month with rainfall far below the average; no gales of importance occurred and the total wind velocity at St. John was 1,100 less than for the same month last year.

November.—Highest temperature 58° at St. Stephen, lowest, —13° at Sussex. In general mild weather prevailed, especially during the first half of the month, while during the latter half, although several mild, bright days occurred, the night temperatures were much lower. The precipitation, which fell mostly as rain, was a little above the average. The snowfall was unusually light in all districts, and excepting a light covering in extreme northern localities the ground was bare of snow. At St. John the total wind velocity for the month was fifteen hundred miles in excess of the same period last year. The most important gales occurred between the 15th and 17th and the 28th and 30th. St. John river frozen over on the night of 14th.

December.—Highest temperature 55° at Fredericton, lowest, —21° at Sussex. The weather was remarkably fine and mild, and, although the snowfall was comparatively light, sleighing was good during the greater portion of the month. In all localities, temperature averages were much above last year, and severe cold spells, as well as continued high winds, were notably deficient. A most important storm moved into this section on the 10th, attended by the heaviest snowfall of the season, with a wind velocity of 48 miles an hour at St. John, the total wind mileage at St. John was some nine hundred miles less than during December, 1904.

ST. JOHN OBSERVATORY,

WIND DIRECTION AND VELOCITY FOR 1905.

1905	N.		N.E.		E.		S.E		S.		S W.		W.		N W.		W.	
Months	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hours	Miles	Hours Calm	Total Miles
January...	194	2,078	77	1373	7	76	29	553	27	518	56	1,323	57	898	211	3,220	86	10,039
February.....	118	1,207	114	1824	8	69	11	131	13	138	42	642	53	535	230	3,606	83	8,152
March.....	138	1,287	34	250	22	164	50	365	88	808	133	1,696	61	637	207	2,650	11	7,857
April.....	115	1,339	28	261	29	222	34	491	111	840	170	2,720	49	531	178	3,046	6	9,450
May.....	97	934	38	360	72	681	17	156	171	1,314	196	2,738	29	288	119	2,121	5	8,592
June.....	55	528	61	689	58	420	49	382	287	1,902	101	752	15	66	74	1,199	20	5,938
July.....	53	387	38	418	54	371	33	246	318	2,305	153	1,425	32	293	44	5 0	19	6,015
August... ...	85	733	100	888	44	184	15	148	292	1,367	86	571	41	147	59	604	22	4,642
September.....	67	535	56	468	25	168	74	532	134	818	152	1,303	21	137	126	2,106	65	6,067
Octobee.....	107	886	61	483	32	279	31	338	60	501	150	2,057	49	423	246	3,804	3	8,771
November	116	1,145	70	465	29	217	35	557	31	652	121	2,038	40	410	276	4,524	2	10,003
December ...	150	1,094	86	981	15	166	54	793	1	18	31	616	148	919	251	2,807	8	7,394
	1295	17,153	763	8460	400	3017	432	4692	1533	11,181	1391	17,881	595	5284	2021	30,257	330	92.925

ST. JOHN OBSERVATORY.

Longitude, 45.17 N. Longitude, 66.4 W.

Months	Barometer			Thermometer			*Cloudiness:* 0 = Clear 10 = Wholly Clouded	*Precipitation:* Rain & Melted Snow	Thunder Storms	Fogs
	Mean	Highest	Lowest	Mean	Max.	Min.				
January....	30.03	30 77	29.22	15.8	47.5	—11.0	5.0	5.77	0	1
February ..	29.93	30.65	29.11	16.5	37.5	3.3	5.4	2.63	0	0
March	30.05	30.57	29.58	29.1	51.3	1.0	4.0	1.44	0	2
April	29.77	30.17	29.31	40.6	63.5	25.0	6.0	1.51	0	3
May.....	29.92	30.43	29.48	47.7	68.5	29.6	6.2	3.30	0	0
June....	29.92	30.26	29.54	54.8	75.6	39 7	6.3	3.94	1	6
July. ...	29 94	30.19	29.55	60.8	79.6	50.0	6.2	2.88	4	1
August	29.94	30.28	29.58	59.9	75.3	46.3	6 2	2.03	1	9
September..	30.02	30.44	29.52	55.2	68.5	36.5	6.6	7.70	1	10
October....	30.04	30 56	29.53	47.2	68.3	26.6	4.1	1.13	0	4
November..	29.89	30.38	29.21	36.9	52.3	12.2	5.7	5.24	0	1
December.	30.00	30.76	28.91	27.5	50.2	2.8	5.7	5.20	0	2

The mean height of the barometer was 29.95. The highest reading 30.77, and the lowest 28.91. The mean temperature for the year was 41.0, which is 0.8 lower than average for the past thirty-three years. The maximum temperature was 79.6 on the 10th of July; the minimum —11.0 on January 15. The total precipitation was 42.77, which is 3.21 inches below the average of thirty-three years. First frost occurred on 11th of October, and the last on the 7th of June. Aurora was observed the 24th of June, 5th of July, 26th of September and 14th of November, and at 9.30 p.m. of December 18th a meteor of unusual brilliancy was observed.

D. LEAVITT HUTCHINSON,
Director, St. John Observatory.

OFFICERS AND COMMITTEES OF THE NATURAL HISTORY SOCIETY FOR 1906.

PATRON.

His Honour the Lieutenant Governor.

OFFICERS.

President—Hon. J. V. Ellis.
Vice-Presidents—G. U. Hay, Ph. D., G. F. Matthew, LL. D.
Treasurer—A. Gordon Leavitt, Esq.
Secretary—W. M. McDiarmid, Esq.
Librarian—W. L. Ellis, M. D.
Curators—Messrs. S. W. Kain, Wm. McIntosh, J. W. Banks.
Additional Members of Council—Messrs. J. Roy Campbell, H. G. Addy, M. D., W. F. Burditt.

LADIES' ASSOCIATION.

President—Mrs. G. F. Matthew.
Vice-Presidents—Mrs. G. U. Hay, Mrs. H. G. Addy.
Secretary—Miss Edith McBeath.

STANDING COMMITTEES.

Archaeology—S. W. Kain, A. C. Smith, M. D., Miss A. D. Jack.
Botany—G. U. Hay, W. F. Ganong, J. Brittain, J. Vroom.
Entomology—W. McIntosh, A. G. Leavitt.
Geology—G. F. Matthew, W. L. Bailey, G. Stead, Wm. McIntosh.
Finance—A. G. Leavitt, J. R. Campbell, W. F Hatheway
Lectures—G. U. Hay, H. G. Addy, G. F. Matthew, J. A. Estey, W. F. Burditt.
Library—W. L. Ellis, Wm. McIntosh, Mrs. W. F. Hatheway, Mrs. G. U. Hay, Miss E. McBeath.
Microscopes—W. L. Ellis, G. W. Melville, H. W. Mowatt.
Ornithology—A. G. Leavitt—Wm. McIntosh, J. W. Banks, Mrs. G. U.
Rooms—H. G. Addy, Mrs. G. F. Matthew, Mrs. G. U. Hay. Hay, Mrs. Lord.
Press—G. U. Hay, A. G. Leavitt, Wm. McIntosh, W. L. McDiarmid, G. F. Matthew.
Publications—G. F. Matthew, S. W. Kain, G. U. Hay, A. G. Leavitt, W. L. McDiarmid.
Astronomy and Meteorology—W. F. Burditt, J. R. Campbell, Wm. Murdoch, Mrs. G. U. Hay.

NOTICE.

The Bulletin of this Society contains articles relating to New Brunswick that are of interest to students of Natural History and the related Sciences.

In it are articles by Prof. W. F. Ganong on the Mollusca, Echinodermata and on the Natural History and Physiography of New Brunswick——On Physiography and Hydrography of N. B., by Drs. G. U. Hay, Prof. L. W. Bailey, J. W. Bailey and Dr. G. F. Matthew——On the Culture of the Stone Age by Prof. L. W. Bailey, Dr. G. F. Matthew and Mr. S. W. Kain——On the Crystalline and Volcanic Rocks by Dr. W. D. Matthew———On the Geology and Palæontology of the Cambrian Siburian and Devonian, and on Fossil Footprints by G. F. Matthew———On Tidals and Magnetic Phenomina by Prof. A. W. Duff ——On Insects by Wm. McIntosh———On Artesian and Fissure Wells by G. F. Matthew and S. W. Kain———On Surface Geology by Geoffrey Stead ———On the Land Snails by Mr. G. W. Bailey———On Earthquakes by S. W. Kain———On Ichthyology and Shrews by Dr. Philip Cox———On the Recent Flora by Dr. G. U. Hay and J. Vroom.

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